New Plant of the H. Mueller Manufacturing Co., Sarnia, Ont.

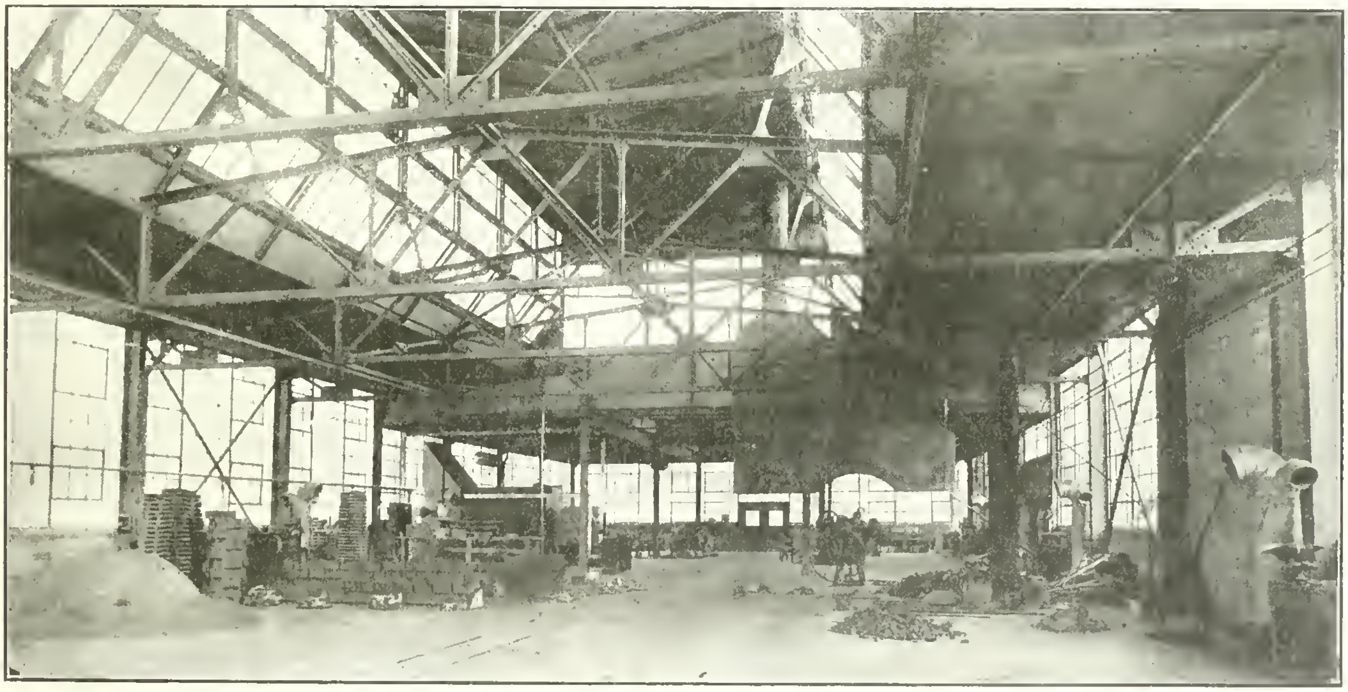
Staff Article

The new factory which the H. Mueller Mfg. Co. have built at Sarnia, Ont., is another instance of American enterprise in the Canadian industrial sphere. It is further evidence of the confidence which manufacturers across the line have in the Canadian market.

THE new factory at Sarnia, Ont., built by the H. Mueller Mfg. Co., Ltd., went into operation on June 1, 1913. It is perhaps the most modern and best equipped factory in Canada for manufacturing all kinds of plumbers' supplies and steam, water and gas specialties. The H. Mueller Mfg. Co., of Decatur, Ill., the parent concern, have a reputation for high quality goods and it is the aim of the Canadian company to live up to the same standard; with this end in view they have built and equipped the plant here described.

The foundation of the parent business may be traced back some years ago when H. Mueller invented and manufactured an apparatus for drilling and tapping holes in water mains when under pressure. This machine, in an improved form, although the same in principle, has been retained, and is to-day one of the company's chief products. A large number of these machines now in use were made at Decatur. From that time, the business has made rapid progress until now it is even perhaps the largest firm in the United States making plumbers' supplies. During the construction of the factory at Sarnia, Mr. O. B. Mueller lived for a greater part of the time, in a house on the site, known to many as "the 49." It still stands, and is now used as an office.

The company purchased a site covering 73 acres on what was part of an Indian reservation to the south of the town of Sarnia and outside the town limits. The property lies on both sides of the Pere Marquette Railway, and has a frontage of 1,200 ft. on the St. Claire river. Ten acres were sold at a later date, five acres were appropriated for the present plant, and the rest is being held for future extensions. On part of the property was an old chain works which has been converted into a modern shop, now known as the iron finishing shop. A siding from the railway runs through the property and shipping facilities are further improved by the dock on the river front. It is the intention of the company, later, to build a three storey building on the river front, the bottom floor of which will be on the dock level and will be used as a shipping room. This will considerably improve the shipping provision for goods destined for the western market. At the present time about 100 men are employed, and the prospects are decidedly encouraging.



INTERIOR OF BRASS FOUNDRY.

Buildings.

The plant and buildings were designed and laid out by Prack & Perrine, factory engineers, Hamilton, Ont., while the construction was carried out by local contractors and the equipment installed under the supervision of the Company. The buildings are of reinforced concrete and brick construction with steel roof trusses and concrete roofs, making them practically fireproof. They are all one storey high and so have the benefit of a roof light in addition to the windows which extend the full length of the buildings and are fitted with Kahn steel sash and factory ribbed glass. The roof of the brass finishing shop is of the saw-tooth type and the foundry has a monitor roof for about 128 feet, the remainder being of saw-tooth construction. In the iron finishing shop, the old peaked roof has been retained but additional windows have been added. Concrete floors are laid in all the shops. The layout of the plant as will be seen from the illustrations provides for a continuous movement of the products in one direction. From the core room to the stock room, the equipment is so arranged that the operations follow each other in regular sequence.

The iron finishing shop is 250 ft. by 44 ft., with an office adjoining, 50 ft. x 35 ft, which is taken up by the drawing and superintendent's offices. On the east side of the property and parallel to the railway is the foundry 192 ft. x 60 ft., and on the north side is the brass finishing shop 276 ft. x 60 ft. and temporary offices 26 ft. x 18 ft. The power

house at the south end of the property is 76 ft. x 66 ft., beyond which is the fuel oil storage near the tracks. The enamelling shop is situated in the middle of the yard or concourse. An industrial track system is laid through each shop and connection is made with each by turntables.

Tunnel System.

A system of tunnels has been constructed between the power house and the various buildings. The tunnels, of reinforced concrete construction, are of sufficient height to permit walking through and strong enough to allow teams to pass over. The interior has been waterproofed and is perfectly dry. The tunnels were built to carry all the steam, air and water piping and electrical wiring to the shops, the obvious advantage being that all pipes, etc., are accessible and digging is eliminated when additional pipes have to be installed, or repairs require making. In the tunnel are laid all the wires for lighting and power purposes, also the 5 in. live steam pipes for the engines driving the ventilating system fans; the 10 in. low pressure steam pipes for the heating coils, and the 6 in. pipes carrying the returns from the heating coils back to the vacuum pump in the engine room. Electric lamps are installed at certain intervals to allow for close inspection of piping and wiring.

Iron Finishing Shop.

In the iron finishing shop are made most of the tools such as cutters, reamers, dies, chasers, etc., that are used in the manufacture of the product. The Company have in many cases their own special methods for certain operations and so require special tools. The tool department occupies the larger part of this building and is equipped with the necessary apparatus which comprises two natural gas furnaces for hardening and tempering cutters, reamers, etc. In connection with the furnaces is a No. 4 "Sturtevant" high pressure belt-driven blower. The furnaces were supplied by the American Gas Furnace Co., New York. In this department there is a foreman's office and tool stores. There are also several machine tools, which include a Le Blond miller, lathes, by the Hendey Machine Co., Torrington, Mass., a Brown & Sharpe universal miller, a "New Yankee" drill grinder, "Universal" bath grinder, milling machines by Kearney & Trecker, Milwaukee, and several stand grinders.

POLISHING AND PLATING DEPARTMENT.

At the south end of this building is a stock room for shop supplies and the north end is devoted to pattern making.

In the west side between the superintendent's office and the main building is a room equipped with a row of lavatories which are equipped with Mueller fittings.

The Foundry.

The foundry is devoted exclusively to the production of brass castings. At the south end is the core room containing several portable core benches, steel core racks and a natural gas heated core drying oven which is equipped with a steel hood and stack. In another section are installed a Gould & Eberhardt core sand mixer and resin crusher supplied by the W. W. Sly Mfg. Co., Cleveland. These machines are driven by a 5 h.p. motor. A machine for bending core wires will be installed later.

In the molding section is a No. 40 "Schwartz" oil fired brass melting furnace, air being supplied by a No. 1 "Sturtevant" high pressure blower operating at 425 r.p.m. The blower is driven through gears by a C. G. E. motor running at 860 r.p.m. Above the furnace is a steel hood and stack for carrying off the fumes. Near the "Schwartz" furnace is a pit furnace for melting brass in crucibles, with a steel stack in connection. Along the west wall are a number of core benches and squeezers with a compressed air installation.

At the north end is the cleaning room where are installed the tumbling mills, made by the Company, grinders, and a "Bliss" press for breaking off the gates, etc., on the castings. Here also is a "Dings" motor driven magnetic separator for removing particles of iron that may be in the brass scrap. This machine was supplied by the Dings Electro-Magnetic Separator Co., Milwaukee.

INTERIOR OF TOOL MAKING DEPARTMENT.

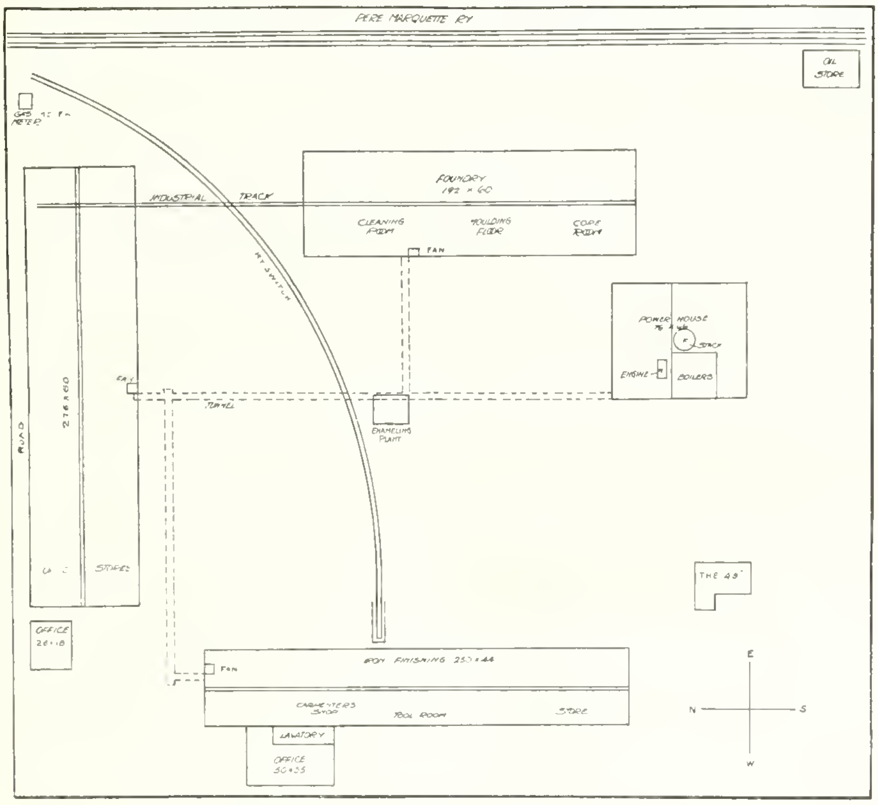
Brass Finishing Shop.

In the brass finishing shop, the castings are machined, polished, and tested, and in the store room at the west end are stored preparatory to shipping. The castings are wheeled in from the cleaning room to the brass finishing department at the east end of the shop. When operations have been completed there, they are taken to the polishing and buffing machines, then to the assembly department near which is the test bench. On the opposite side of the shop from the assembly department is the nickel-plating department where all plated goods are treated.

In the brass finishing department are several standard tools and also some special types. The former include Warner & Swasey turret lathes, a three spindle drill by A. R. Williams Machinery Co., drills by Canadian Fairbanks-Morse Co., and an automatic machine by the New Britain Machine Co. Along the north side of the building are several buffing machines, and nearer the centre are a row of polishing machines. All these were supplied by the Bennett-O'Connell Co., Chicago, and are each equipped with galvanized iron hoods and ducts for removing the dust. In connection with this system are two motor driven Sturtevant blowers which carry the dust from the machines through the ducts to the dust catchers on the roof outside, the dust being returned to the shop by a down pipe to have the brass particles taken out.

All the goods sold by the Mueller Co. are covered by an unconditional guarantee which they are able to do as each fitting is tested by hydraulic pressure before shipment. The testing bench in this shop has stands for holding various kinds of bibbs, cocks, etc., and is equipped with a "Deming 3 in. x 3 in. motor driven triplex pump, which is connected to the test stands. The testing outfit is equipped with gauges and "Mueller" water pressure regulators.

The stock and shipping room at the west end of this building is equipped with steel racks, arranged in divisions each holding four steel stock or "tote" boxes. The racks and boxes were made by the Company in accordance with the system which they have in force in the stock room at Decatur. Each box is numbered and its contents noted in the stock record from which can be seen at a glance the kind and quantity of goods in each box. When the quantity has reached a certain limit, an order is put through on the shops for a further supply.



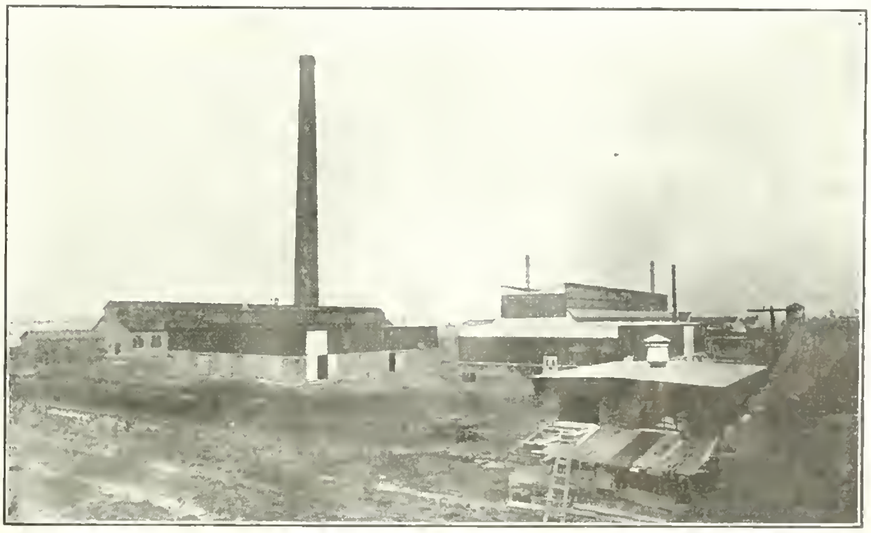
LAYOUT OF THE H. MUELLER MFG. CO. PLANT.

In this building is a "Curtis" vertical belt driven air compressor having a capacity of 150 ft. of free air per minute. Air is piped to the other shops through the tunnel. The Company contemplate installing a larger unit in the near future. A row of enamelled iron lavatories, equipped with "Mueller" fittings, is installed in this shop.

The Power Plant.

As already stated, the power house is 76 ft. x 66 ft. and is divided into two sections by a brick wall; one side, the north, forming the engine room and the other side containing the boilers, heater and pumps. The base of the chimney is also in this latter section. The walls are of brick construction up to half way, above which line are windows fitted with steel sash and ribbed glass, extending all round the building and giving a very bright effect to the interior. Many of the windows open, giving good ventilation. The absence of coal in the boiler room, natural gas being used, gives the plant a clean and tidy appearance. There is ample space for installing a complete duplicate set when the necessity arises.

In the engine room is installed a Robb compound vertical high speed engine, direct connected to a Canadian General Electric 187 k.v.a., 60 cycle, 3 phase, 450 r.p.m. generator and a C.G.E., 125 volt exciter. The engine is rated at 200 i.h.p., running 450 r.p.m at 140 pounds



VIEW OF PLANT SHOWING FOUNDRY AND POWER HOUSE.

steam pressure. It is equipped with forced lubrication, a "Sweets" throttle governor, and has cylinders 13 in. x 19 in. diam. x 9 in. stroke. The International Engineering Works, Ltd., Amherst, N.S., supplied the engine. The usual gauge board with pressure gauges and clock are of course located in the engine room.

In the boiler room are two Sterling water tube boilers each rated at 250 h.p. and having working pressure of 140 pounds. They are fitted with "Kirkwood" burners for natural gas at a pressure of 8 ozs., a gauge being fitted for indicating the pressure. There are 10 burners to each boiler and these were supplied by Tate, Jones & Co., Pittsburgh. Martin shaking grates are fitted in case it should be necessary in an emergency to change over from gas fuel to coal, the burners being so arranged that the change can be made in a few minutes. Near the boilers is a 600 h.p. "Cochrane" open type feed water heater fitted with a multi-port safety exhaust on the valve and in connection with it are two 6-4-7 duplex boiler feed pumps. The heater and pumps were supplied by the Canadian Allis-Chalmers Co. The pumps deliver feed water to the boilers at 210 degrees under the control of a "Copes" feed water regulator, and are each fitted with a "Mueller" pump governor, made in their factory. "Powell" non-return valves are fitted in the steam leads to the header and the pipe lines are equipped with "Kiely" high pressure steam traps.

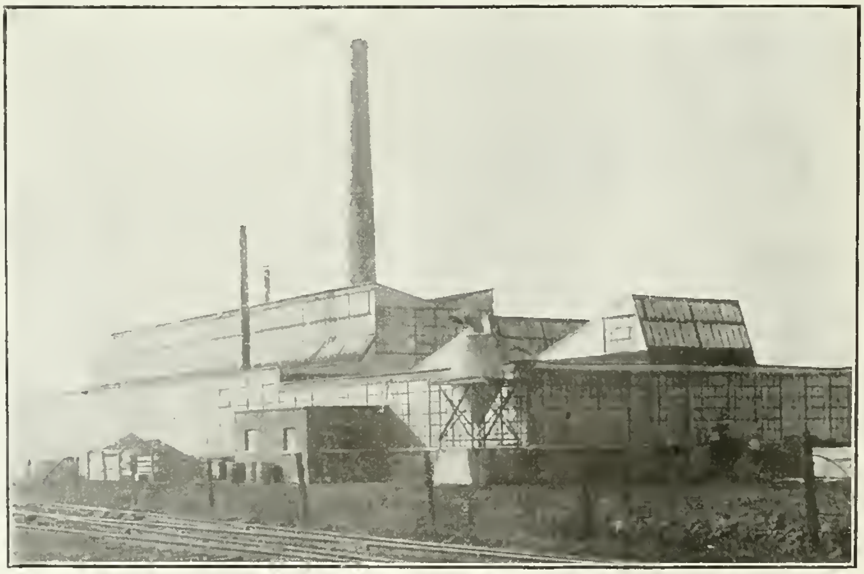
The steam pipes and fittings were furnished by the Canadian Kellogg Co., Ltd., Montreal, and are covered with the Kisselguhr Co., "Nonpareil" pipe covering. All the valves were supplied by the Wm. Powell Co., Cincinnati. The radial brick chimney 125 ft. high and 14 ft. diameter at the base, inside, was built by the Heinicke Co., New York. A high pressure 5 in. steam line is carried through the tunnel to the fan engines, and a 10 in. low pressure line from the engine exhaust to the heating coils. These pipes are carried on racks in the tunnel and on the high pressure line is a "Mueller" reducing valve for reducing the steam pressure from 140 to 100 pounds. The low pressure pipe is fitted with a "Mueller" regulator which allows live steam to enter the line if there is a deficiency of exhaust steam. The regulator is fitted with a strainer and is one of the company's specialties. A "Marsh" vacuum pump is installed at the engine room end of the tunnel to return drains from the heating coils to the heater. The pump was supplied by the A. R. Williams Machinery Co.

CORE DEPARTMENT.

Power and Light Distribution.

In the engine room is a switchboard, which consists of four panels of black marine slate, each panel having two slabs, 25 in. and 65 in. respectively, by 2 in. thick, with ½ in. bevel edges. The first panel is 24 in. wide, and controls the 175 k.v.a. 60 cycle, 440 volt generator and exciter. On this panel is mounted the following: One 3-pole, single throw, 300 amp. automatic breaker; one field discharge switch; one type (F) ammeter, 300 amps.; one voltmeter receptacle; three ammeter receptacles and plugs; one type (F) voltmeter. The second panel is blank, while the third and fourth are feeder panels. At the back of the switchboard are three 10 k.w. and one 30 k.w. single phase Canadian Westinghouse transformers, which reduce the current from 440-220-110 volts. The former set include one transformer for each shop, and the latter is for using with outside current. In each shop are installed 150 watt wire drawn "Mazda" lamps with D'Oblier holophane reflectors, suspended in the centre of the shops in single units and spaced about 20 ft. apart. The lamps are supplied with single phase current at 110 volts and are controlled from a distributing panel in each building. Lead covered cables are laid in the tunnel from these panels to the main switchboard in the engine room.

C. G. E. induction motors, 440 volts, are installed in the various buildings. In the machine shop a 20 h.p. and 7½ h.p. motor drive the line shaft and in the brass finishing shop 20 h.p. and 30 h.p. motors drive the line shaft, while two 15 h.p. motors drive the blowers in connection with the dust removing system and a 5 h.p. motor drive the "Deming" pump on the test bench. In the foundry, a 15 h.p. motor drives the line shaft, a 7½ h.p. motor operates the blower in connection with the dust removing system installed with the grinders, a 5 h.p. motor drives the machine in the core room, and a ½ h.p. D.C.



EXTERIOR OF BRASS FOUNDRY.

motor operates the "Dings" magnetic separator.

Heating and Ventilating System.

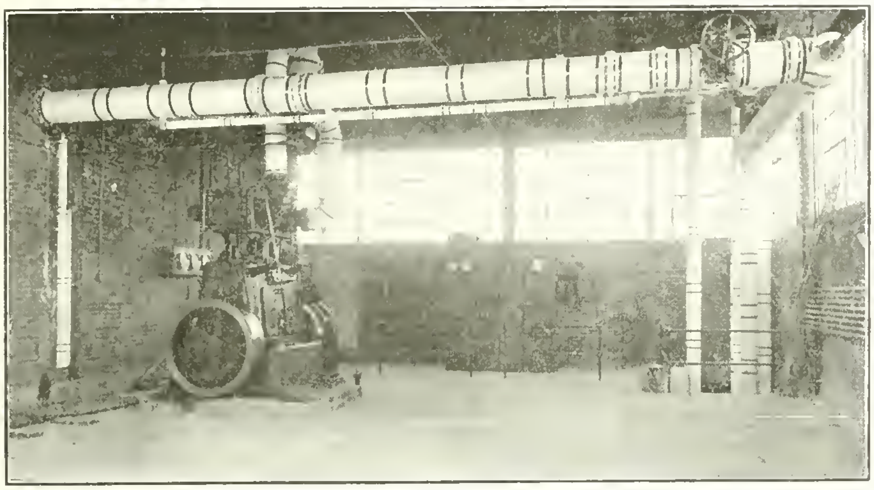
In each shop is installed a heating apparatus consisting of a "Sturtevant" fan, engine and heating coils and guaranteed to maintain a temperature of 70 degrees when the outside temperature is 20 degrees below zero. In the iron finishing shop, the air ducts are carried over the roof trusses and so arranged that the air can be re-circulated through the building. In the foundry and brass finishing shops, the air is not recirculated but drawn fresh from outside continually. In these two shops, ducts from the fan are laid under the floor, with risers at various points about 6 ft. high terminating with a three-branch delivery.

The fan in the iron finishing building is a 120 in. full housing steel fan with single inlet and top horizontal discharge direct connected to a 6 in. x 9 in. steam engine, horizontal type. The pipe coil heater contains 4,445 lineal feet of 1 in. steel pipe on 6 four row heater bases. The sections are arranged for a 3 in., inlet, 2in. drip and 1 in bleeder, and are jacketed top, bottom and two sides with steel plates connected to the inlet of the fan so that the latter draws air over the heater pipes. In the brass finishing building is installed a 7 x 4, 3/4 housed steel plate Sturtevant fan having a right hand bottom horizontal discharge, and driven by a 7 in. x 10½ in. horizontal steam engine. A pipe coil heater containing 6,328 lineal feet of 1 in. steel pipe is used and built in seven 4-row sections of heater bases with the same connections as the above fan, and steel plate jacketed on the top, and two sides connected to the inlet of the fan so that air is drawn through the heater by the fan suction. There is a 6 x 3½, 3/4 housed fan in the foundry driven by a 6 in. x 8 in. horizontal steam engine. The heater contains 5,162 lineal feet of 1 in. pipe. In other respects this fan is identical with that in the brass finishing building. Eighty pounds steam pressure is supplied to all the fan engines, and the exhaust steam for the heating coils is supplied at two pounds pressure. Pipes to each unit from the power house, are laid in the tunnel.

General Features.

Although the company only started manufacturing in June, considerable progress has been made, and the plant now is in good working order. The original plans called for a much larger plant than exists at present but additional buildings will be added from time to time as the expansion of the business makes it imperative. In the layout of the plant provision has been made so that future extensions will not interfere with the present system.

The officers of the company are Oscar B. Mueller, President, C. G. Heiby, Vice-President and Superintendent, Adolph Mueller, Treasurer and F. L. Riggin, Secretary.



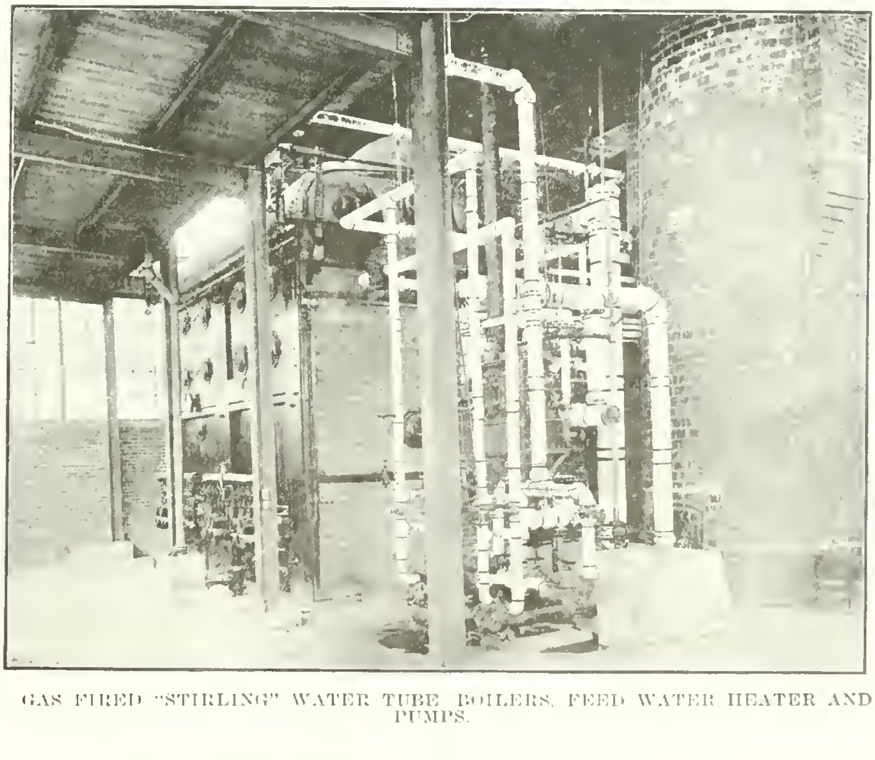
ENGINE ROOM SHOWING ROBB FORCED LUBRICATION TYPE ENGINE.

CANADA STEEL CO., HAMILTON, ONT.

THE plant of the Canada Steel Co., Hamilton, was almost demolished by fire during August, and by November was reconstructed. Opportunity was taken to extend the plant. The new building is of steel and absolutely fireproof. Adjacent to it is a machine shop of concrete and steel construction.

The Canada Steel Co. was incorporated in 1911 for the manufacture of rail-carbon steel. The output consists of flats, rods, squares, angles, reinforcing bars, and specialties in bar steel and iron, rolled from selected old steel rails. The rails are broken into suitable lengths, and are pushed into the furnace by an electrically operated ram, the feed being continuous. When the rails have reached the proper heat, they are taken out and passed through the rolls. The head of the rail is separated from the web and flange, and is rolled into rounds, squares and flats, while the others are converted into shapes. The furnace and rolling mill were not much damaged in the recent fire, and are still in service.

A new furnace and mill recently installed are to be used specially for irregular stock, which cannot be used in the other mill. It is a four-side, sand bottom furnace, 45 ft. long, with cast iron shell, lined with firebrick, the odds and ends about the plant being fed in at the side doors, and not continuously. In the larger furnace the rails are pushed in continuously at the coolest end of the furnace. After reaching the desired



GAS FIRED "STIRLING" WATER TUBE BOILERS, FEED WATER HEATER AND PUMPS.

heat, the stock is withdrawn from the sides, and carried up through 12-inch Belgian roughing rolls, and passed on to the 8-inch finishing rolls, where it is brought down to final size. This mill has been specially designed to manufacture small channels—$\frac{3}{4}$, $\frac{7}{8}$, inch, etc., and small T bars, angles, squares and rounds, from $\frac{1}{4}$ to $\frac{3}{4}$ inches. From the rolls the stock is carried to the hot beds and straightening beds, then to the shears and weighing machine, and eventually to the cars. The roughing and finishing mills were supplied by the United Engineering and Foundry Co., Pittsburg, and were erected on foundations fourteen feet deep.

Ahead of the old rolling mill the Steel Company have installed an 8-inch train of rolls, consisting of a set of pinions, one three-high, and one two-high set of rolls, to be used whenever a section being finished on the web is holding back the rest of the mill, or, in other words, when the other two bars in the mill are being finished quicker, and one is waiting for the web bar to be finished. These have been supplied by the same concern as the above.

MACHINE SHOP INTERIOR, CANADA STEEL CO., HAMILTON.

Power Plant.

Following the fire, it was found necessary to build a new power house, and to instal a new motor and driving equipment for the big rolling mill. Power is supplied by a 1,000 h.p. Canadian Westinghouse motor, taking current from the Dominion Power and Transmission Co., at 2,200 volts, 60 cycles. The power is transmitted to the rolls by means of a continuous rope, two-thirds of a mile long, and a flywheel weighing 20 tons, direct connected to the mill. The tension is taken up by a pulley on a traveling carriage, controlled by weights.

The power house is built of brick and concrete, and measures 25 x 60 ft. The driving equipment was supplied by the Dodge Manufacturing Co., Toronto, who will also supply the equipment for another power house being erected at the other end of the mill. This will contain a 1,000 h.p. C. G. E. motor, using Hydro-Electric current, connected by rope with a 20-ton flywheel, so that if anything goes wrong with either the other will run both mills. A 5-ton Shaw electric crane was installed this fall for handling all finished product, and a special set of power shears to handle stock from the new mill has been built and supplied by the John Bertram & Sons Co., Dundas.

At the east end of the plant a store room has been built, with racks for storing steel bars. This is equipped with stock shears and a punch for punching cross arm braces and angle straighteners. This addition is served by an independent track, used solely for shipping material from stock. A pattern-making shop has also been erected for making patterns for guides and miscellaneous pieces around the plant. Half this building is used as a general storehouse.

The Machine Shop.

The line shafting is one of the features of the new machine shop, which has been erected a short distance south of the main plant. This was designed by the master mechanic, William Armstrong. Angles were bolted to the pillars, to which were bolted two I beams. The hangers are clamped to the I beams, and can be moved in any direction to suit the pulleys.

Much of the equipment used in the old shop has been saved, including two roll lathes. Another has recently been supplied by the United Engineering & Foundry Co., Pittsburg. Among other new equipment is a large radial drill supplied by the Mueller Machine Tool Co., Cincinnati, O.; a drill by the Sibley Machine Tool Co., South Bend, Ind.; a 12-inch lathe, made by the John Bertram & Sons Co.; a Butler shaper, power hack saw, grinders, etc. New machine tools will be purchased next year, including lathes, planer, 24-inch shaper, and grinders.

A furnace, made by the Dominion Radiator Co., Toronto, was installed this winter to heat this section. It will provide heat for a building twice the size, provision being made for extending the machine shop later. A blacksmith shop has been erected at the western end of this building. There is also an office for the master mechanic, and a draughting room in which all the tools and rolls are designed. The machine shop is of reinforced concrete, with steel frame, the steel throughout all the buildings being supplied by the Canada Steel Co. themselves. The floor is of concrete, except where the roll lathes are situated. Here it is covered with creosoted blocks, as chilled rolls are easily chipped.

William M. Currie is vice-president and general manager, and Alfred Oran, superintendent.

BOILER EXPLOSIONS.

By H. T. Westwood.

BOILER explosions are becoming almost as common at automobile accidents. The latter have now ceased to excite more than a passing interest, and the average individual, on reading an account of one, usually dismisses it from his mind with the chance remark—Well, if they will take the risks, they must also take the consequences.

Of Public Interest.

The public, however, cannot afford to regard boiler explosions in a similar light. It is a question of vital importance not only to the engineer and fireman, but to the public at large, involving the personal safety of everyone employed in a building in which a steam boiler is in service, as well as of those who happen to be in the immediate vicinity. When one stops to consider that nearly every large building in Canada is equipped with one or more boilers upon whose safe operation hang the lives of scores of persons, the gravity of the situation is apparent.

The recent explosion at the saw mill of Manly Chew, Midland, Ont., described in a recent issue of Canadian Machinery, strongly emphasizes two points: First, the necessity of having all parts of the boiler accessible for inspection; second, the necessity of rigid inspection. Failure to comply with the former requirements, however, is no excuse for laxity of the latter.

We should have Government boiler in-

spectors practical men, and the best that can be found would not be too good to fill the position.

If any part of the boiler is inaccessible it should be the duty of the inspector to demand that the owners provide means for its inspection, and furthermore, he should have the power to withhold the certificate until satisfied that the boiler may be safely operated under the particular operating conditions. Engineers, firemen, boiler makers and inspectors are interested in this matter. They live, move and have their being around steam boilers, and explosions touch them deeper than any one else.

A Criticism.

Being one of the craft, may I not examine and question the verdict of the jury in the Midland case?

Two men killed, and their death was accidental.

What caused the explosion?

Here was a boiler with a double riveted lap jointed longitudinal seam, a construction condemned by all experts for reasons that have been explained in Power journals many times. The seams were of lap jointed double riveted construction with the flexure common to that design.

If the plate be weakest, cracks occur. If the rivet section in shear be weakest, then the bending action long continued will result in shearing at mid-section, and granting failure at that point, it follows that the remaining rivets being weaker than the net plate give way by shearing.

In view of the above the verdict of the Midland jury may be set aside as of no value to the men operating steam boilers. The explosion points out again the danger of operating boilers of this construction. No examination short of a water test with the wall removed to permit the seams being examined is of any real value on boilers of this design, and this test should be supplemented by trams over the seams and by steel tape around the circumference of the shell at several points.

That about two boilers explode every day in the United States, and those in Canada becoming more frequent is by no means credible to those supplying us with reservoirs for stored energy.

FOUNDRYMEN IN THE MAKING.

AT a recent meeting of the Lancashire Branch of the British Foundrymen's Association, Mr. W. H. Sherburn—a former secretary of the Association—read a paper on "The Making of a Foundryman." He dealt first with the necessity for apprenticeship, which subject, he said, was now attracting much attention, although hitherto no satisfactory system had been evolved. Technical schools and technical literature had multiplied enormously during the last thirty years, but the training of apprentices was never in a more unsatisfactory state than at present. The matter was vital to the future of the workers.

The craft of the foundryman was second to none in the scope which it offered for capacity of the highest order, and if it had been regarded in the past as only an inferior branch of engineering, this was through bad management and the lack of self-respect of those engaged in the work. There had, however, always been a few worthy craftsmen who had upheld the dignity of the craft and realized its importance. To many people, however, the craft of iron-founding was still a "dirty job," to be got away from as soon as possible. Iron was just iron; sand was sand (or mere dirt), and coke was just fuel; and if only the casting "passed" and was paid for, there was an end of it. It was for them, the Associated Foundrymen, to alter all this and to raise their craft to the position and dignity which was its due.

He suggested an earlier discrimination by those in charge of elementary education of the natural bent and inclination of the children. He thought that more flexibility must be allowed to the teacher, the training of the young proceeding in an even orderly way without any sudden break. The higher standards should give place to an arrangement into groups—mechanical, commercial, or artistic, according to the observations of the teachers during the earlier periods of education. Such a method would facilitate the drafting of boys into industrial life, and greatly reduce that large class of boys who on leaving school did not know what they would like to be put to. In the days of the early Trade Guilds the boy worked and lived in his master's home and imbibed his spirit.

The Half-Timer Feature.

After the lad left school, he thought that the first year of industrial life should be that of a half-timer, to give opportunity for attendance at technical classes. The practical side of the foundryman's craft was much better learned under actual conditions in the workshop, given, of course, competent craftsmen in charge. The remainder of the training, he suggested, should be performed on the following lines.

Two years in the moulding shop under a competent workman—not to be his laborer, but to wait on him and learn the practical use of the tools and materials. The workman should, in fact, be a temporary father to the lad. The practice of drawing must in the meantime be kept up by the pupil, this being of the utmost importance.

If the boy showed an aptitude for drawings and designing, he should spend a year in the pattern shop learning the tools and their uses and the nature of his materials — wood, clay, plaster of Paris and lead. Ater this preliminary time he might be put at the bench under the guidance and control of an experienced workman. In his opinion, it was impossible to design patterns of a satisfactory form, unless the designer had practical and technical knowledge of moulding. Mutual understanding and frequent intercourse between the drawing office, the pattern shop, and the moulding shop were essential to good work.—Ex.

INTERNAL COMBUSTION LOCOMOTIVES.

THE internal combustion locomotive as a factor in main line locomotive practice has now passed the proposal stage, and a number of interesting designs are available for consideration, though as yet practical realization is confined to a very few specific instances.

According to the Railway News, a design recently made public includes two internal combustion engines, each driving an axle through clutches, arranged one at the front and one at the rear end symmetrically to a vertical plane through the centre of the locomotive. The axes of the engine cylinders converging upwards towards the central vertical plane, and the driver's stand and water tank are arranged in the centre. The cooling water for the engines is circulated by pumps through coolers arranged one at each end of the locomotive. Each engine is clutched to its axle by a pneumatically operated clutch.

The arrangement, therefore, produces a 2-10-2 design, with cooler and diagonal engine at each end and driver's cab in the centre, the respective engine shafts being between the leading—or trailing axle, and the driving axle next thereto, gearing transmitting power to the five driving axles, which are actuated through the pneumatic clutches mentioned.

Ottawa, Ont.— Tenders addressed to the undersigned and endorsed "Tender for Submarine Cables," will be received at the office of the Department of Public Works, until Thursday the 15th January, for 10 knots of gutta-percha cable with 4 conductors, and 14 knots of gutta-percha cable with 2 conductors, to be delivered at Halifax, N.S., or St. John, N.B., by the 1st of May. R. C. Desrochers, Secretary.

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

REMOVING, REPLACING AND BEADING BOILER TUBES.

By H. Westwood.

IN a recent issue of Canadian Machinery J. Langridge wished to know "What is the usual procedure in removing, replacing and beading tubes in a return tubular boiler.

The manner of installing tubes does not differ materially with types of boilers. In removing a full set of tubes from a return tubular boiler, a start should be made from the bottom, being the tubes nearest the hand hole. The tube in the front head is cut off with a bar as shown in Fig. 1 while the bead is cut off the tube in the rear end with a hammer and flat chisel. The tube is then worked down and out of the hand hole in the front head.

In case one or just a few tubes are to be taken out the front end is usually split and the bead cut off on the back head. Then, by means of a sledge and special tool, the tube is knocked out of the tube sheet and removed. The ripper shown in Fig. 2 is used in splitting the tube, after which a slit is cut, extending back beyond the tube sheet an inch or two. This allows the tube to be closed in and removed through its own hole.

Scale Trouble.

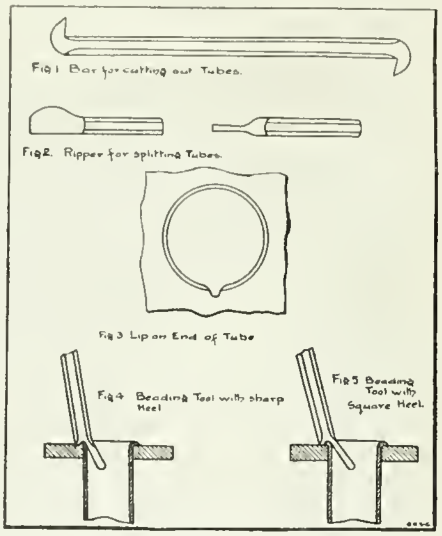
If scale adheres to the tubes to the extent that they cannot readily be removed in this manner then they must be removthrough the hand hole. Should the latter not be in a convenient place, the hole in the tube sheet may be enlarged and the tube extracted through it. For this purpose it is necessary usually to enlarge the hole from 1/8 to 3-16 of an inch, depending upon the amount of scale adhering. It should not, however, be enlarged more than necessary, as it must be reduced to nearly normal size when the new tube is put in. In some cases, especially with the locomotive type of boiler a copper ferrule is placed between the tubes and the sheets. This however, usually applies only to the sheets directly in contact with the flames and hot gases, although some manufacturers use a copper ferrule in both tube sheets.

The replacing of tubes in an old tube sheet must be done with the utmost care. The sheets should be carefully inspected and all scale removed from the inside surface around the hole. The edges of the holes should be chamfered leaving a good fillet to prevent the tube from being cut by sharp edges or burrs. Again, the holes are liable to be out of round, in which case they must be reamed.

In some types of boilers there is a marked tendency for the fire box sheets to expand more in a vertical than in a horizontal direction. This distorts the hole, the vertical diameter being slightly greater than the horizontal diameter. The holes at the centre of the tube sheet usually suffer most from this distortion.

Installing a Set of Tubes.

Before installing a set of tubes, attention should be given to the sheets to see if they are straight, and if not they should be straightened as far as possi-



REMOVING, REPLACING AND BEADING BOILER TUBES.

ble. This is accomplished by means of bars and bolts. When the sheet has been straightened, a number of tubes, depending upon the size of the boiler, are temporarily fastened to both sheets to permit the removal of the straightening bars, after which the balance of the tubes can be inserted and the operation completed.

It is general practice, with tubes which are beaded at one end and the other end expanded only to cut them the desired length before inserting into the tube sheets. Some times there is more or less variation in the lengths of the tubes in which case the tube sheet is divided into sections, the tubes of each section being cut the same length. They are then marked for their respective sections, and when installed all will project from the sheet about the same distance.

If the tubes are to be beaded at both ends, then the measurements should be taken with more care, and the variation between the sections should not exceed 1-16 of an inch. Some boiler manufacturers design their boilers so as to use a special length of tube. All the tubes are usually about the right length and those that project too far beyond the sheets are cut off at the desired point by a special machine, although frequently a flat chisel and hammer is used. Tubes expanded into the sheet and not beaded should not extend beyond the sheet over 3-16 of an inch. Those which extend too far beyond the sheets not only prevent proper expansion but also permit the surplus part of the tube, which is not cooled by the water, to be burned or wasted away.

The Rolling Feature.

Tubes are tightened into the sheets by means of a roller or sectional expander. When the tube is inserted into the hole it should project beyond the sheets 3-16 to 1/4 of an inch, which amount is allowed for the bead. The tube is held temporarily by lipping the tube with a hammer as indicated in Fig. 3. The tip will hold the tube in position while it is being expanded. Usually about four turns of the expander will force the tube out against the sheet. The use of a heavy maul for driving the mandril should be discouraged, as the blows struck upon the mandril should not be heavy enough to cause the tube sheet to warp or spring.

The tubes ought to be worked to the sheet, and if this is done properly the sheet will not be distorted. A large tapering pin should never be used to enlarge the tube. The copper ferrules are annealed before being put into place and must be a neat fit. If too small for the hole, they may be stretched and reannealed. In expanding tubes with the roller expander, the mandril should be forced in only a short distance at a time, otherwise humps will form and make the rolling unsatisfactory.

In rolling leaky tubes, expand them very lightly and use an ordinary hammer on the mandril. It is not well to remember that heavy pounding is not required to tighten the tube in the sheet, as the tube has already the full contour of the expander. Beading the tube is very important. A beading tool constructed with a sharp heel is very liable to result in the sheet being cut when the bead is calked. In Fig. 4 is shown a

beading tool having a sharp heel, also the manner in which it cuts the sheet, while Fig. 5 shows a beading tool with a square heel which prevents the cutting tendency.

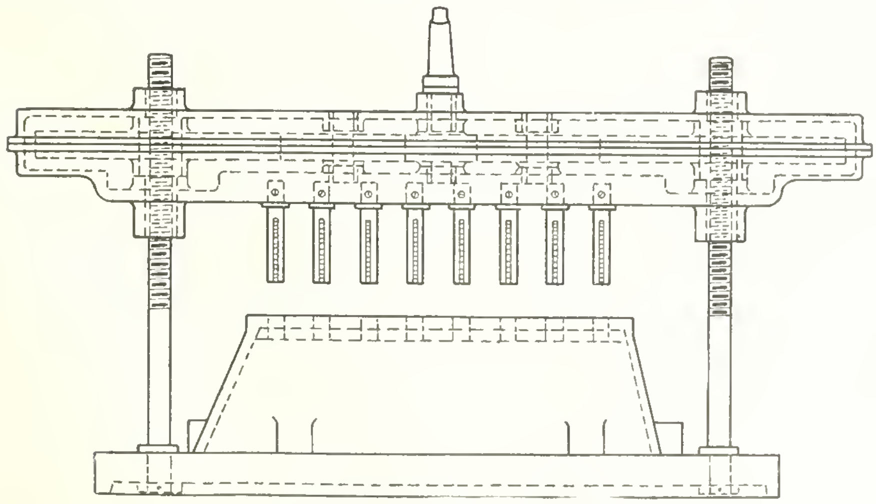
BROACHING ON THE DRILL PRESS.

By D. S. Mann.

ANYONE who possesses a good, first-class drill press now considers that he has a complete machine shop, and perhaps rightly so. The writer has used drill presses for all kinds of work from boring cylinders to cutting key-seats, yet he recently ran onto an operation in an automobile factory which was new to him, and will probably be to many readers. The job was on the upper half of an automobile engine crank-case. The push rod bearing guides were provided with keys to prevent their turning in the case, and the job in question was broaching the eight holes for these guides. The cases were of aluminum, and were laid on the base of the fixture shown and centered by means of dowels in holes which had previously been drilled. The fixture as shown was simply set on the drill press table, a tapered shank being provided for driving the mechanism. The drill press was provided with a tapping attachment so that the broaches could be quickly run out, and this was probably the main reason for using on the press.

Of course, the fixture could have been driven by a separate attachment and been complete in itself, but the way it turned out the work was a sight worth seeing, and was, therefore, used only a portion of the time. Five gears comprise the driving mechanism, the centre pinion being integral with the tapered shank, and driving through the two idlers the larger gears at the ends, which are provided with bronze nuts in the centre, fitting the vertical screws. The casing itself is fitted with bronze bushings above and below these nuts, sufficiently long to properly guide the arrangement. As the centre pinion is revolved, the outer nuts travel up or down according to the direction desired. The main point to be noticed in the whole arrangement is that there is no thrust on the spindle of the press, all the stresses being self-contained. The broaches are held in the bottom of the frame by set screws, and have shoulders to take the thrust, also having keys to line up the cutting edges in the proper position.

There was need to clamp the work but lightly, as the cutting was all done directly downwards, the only upward pull being on withdrawing the broaches. The fixture, in comparison to the work being done and the time saved over any other method was remarkably simple, and at the same time cheap and sensible. It only goes to show one more use for our old friend the drill press, and in the near future we will not be surprised in the least to hear of some firm starting in the automobile game with only a few drill presses.



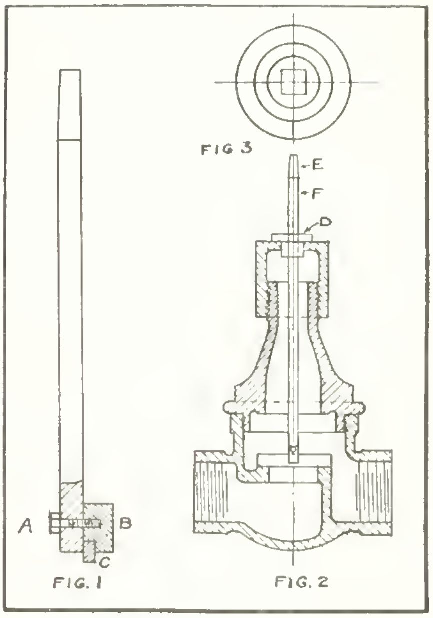
BROACHING ON THE DRILL PRESS.

A JENKINS VALVE RESEATER.

By J. E. N.

SOME years ago I made a tool to reseat Jenkins style valves, and Figs. 1, 2, and 3, show it. The square iron rod (F) can be tapered slightly at the top if required, and for valves up to 2 inches diameter, a 3/8 inch rod is big enough as this size rod will fit nicely into a breast drill. A 3-16 in. or 1/4 in. in. bolt (A) holds the clamp (B) in place, and the latter can be made from a piece of iron 3/8 x 1/2 inch. This clamp holds in place a piece of file (C).

To use the apparatus, remove the bonnet and valve stem, then remove the stem from the bonnet and place the rod and file in its place and screw on the bonnet again. As the stems in different sized valves arre not the same in diameter it will be necessary to get a few small bushings (D), made. By placing the tool as shown and giving it a few turns with a brace or breast drill, a new face will be ground on the valve seat,



JENKINS VALVE RESEATER.

and if absolute smoothness is desired, remove the file, after turning the new seat, and place a short piece of tool steel in its place. A few turns with this latter on the filed seat will make it absolutely smooth.

It is obvious that different lengths of file and steel will be required for different sized valves. This tool costs only a very small sum of money in any case, to make or even get made, and it will positively make a true and smooth seat on valves from 1 1/4 inch up to 2 1/2 inch with only a few minutes work. The valve can be repaired without removing it from the pipe, but care should be used to see that all brass filings are washed out before replacing the stem and disc.

BOILER SHELL FORMULA QUERY.

By John J. Grancis.

IN a recent issue of Canadian Machinery there appeared a very clear and concise report by T. J. Main on the recent boiler explosion at Collingwood., Ont. I shall be glad, however, to have an explanation concerning the fraction .69 appearing in the numerator of the formula there given, and meantime presume that his calculation is based on the following general and universally accepted formula for arriving at the working pressure of steam boiler shells:—

$$W.P. = \frac{TS \times t \times E}{R \times F}$$

where (TS) = tensile strength and (t) the thickness of the shell plate, (E) the

lowest efficiency of shell plate and rivets at the longi'udinal seam, (R) the radius of the boiler shell, and (F) the factor of safety. If (E) or .69 in Mr. Main's formula is the lowest efficiency of shell plate or rivets at the longitudinal seam, what is the tensile strength of the plate and the shearing strength of the rivets allowed by him?

Editorial Explanation.

It is quite evident from Mr. Main's formula in both instances that 60,000 pounds per sq. inch has been taken as the ultimate tensile strength of the shell plate, and his idea in using it on the second occasion, with a much reduced shell plate thickness and most certainly bereft of more or less of its original strength, even if it did happen to have been 60,000 pounds per sq. inch when new, is intended to demonstrate more clearly that, even under such circumstances, 25 pounds per sq. inch working pressure was the limit of the boiler instead of 80 pounds—the pressure carried, when it blew up.

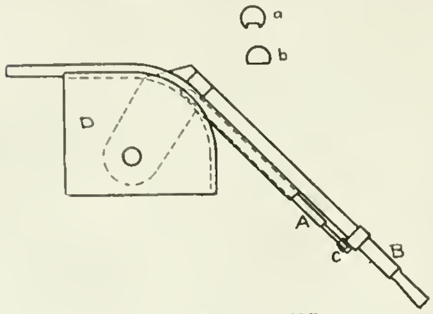
Regarding the shearing strength of the rivets, we have no doubt Mr. Main reckoned this at from 82 to 85 per cent. of the tensile strength of the plate, and although it does not appear to be definitely stated in the article covering the report, the longitudinal shell seam must have been of the double riveted lap type, at least. The omission to note the type of joint in the report naturally induces speculation relative to the fraction .69 in the formula, especially as one would gather from the data generally that the joint was only single riveted lap, and would have, as a consequence, a rivet section value of but .56.

In a succeeding issue we will endeavor to have Mr. Main indicate the type joint and make whatever additional observations he cares to.

BENDING TUBING.

By D. S. Mann.

THE following arrangement was used in putting the right angle bends in the tubing used for the outer frame of automobile wind shields. The section of the tubing is shown at (a), although the method is adaptable to any shape, either round or special. The block (D) was bolted to the table and had a circular groove around the edge. The lever (B) was operated by hand and the rod (A) first slipped into the tubing, and held at (C) by a slot in the clamp. A section through the rod (A) is shown at (b). The inner end of this rod was rounded off just at the beginning, or rather the ending of the bend, looking at it from that end. This end just followed the curvature as the lever (B) was brought around. All the actual bending took place, however, over the end of this rod, and deformation was absent due to its shape. Of course, for any special piece there would of necessity be some few trials to determine the exact length of



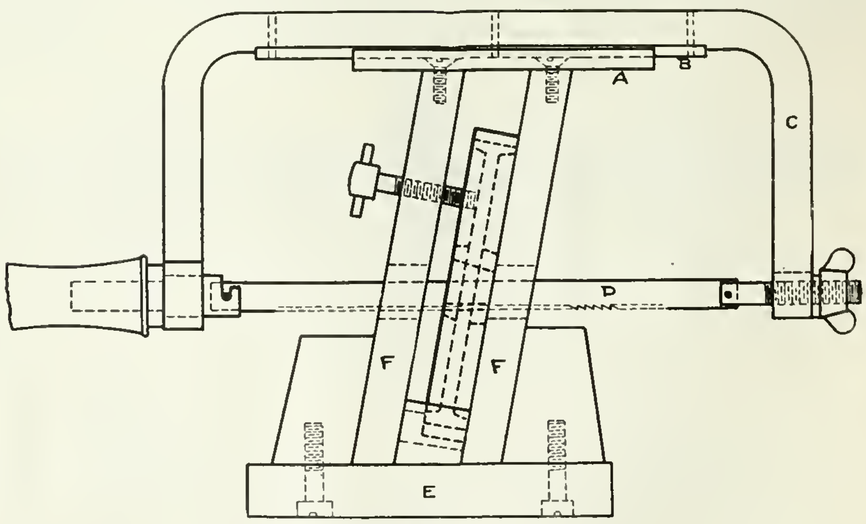
BENDING TUBING.

the inner rod. The job done on this fixture was perfect as far as could be seen, and there was no delay, as the rod fitted in the tubing rather loosely and the two shoulders at (C) held it in the same relative position at all times to the lever (B). Anyone who has had pipes or steel tubing to bend can appreciate the difficulties experienced, and is advised to try this method.

KEYSEATING MAGNETO GEARS.

By D. O. Barrett.

STANDARD magneto shafts for automobile use are provided with tapered ends, keyseated, and with a nut for holding the driving gears on shaft. The keyseating of these gears is an annoying job, due to the steep taper and the small size of the hole. The drawing shows the method we pursued in handling the job. The base (E) is clamped in a vise, the gear slipped in at the side between the pieces (F F), and resting in a V-block, being held solid by means of a clamping screw. The steel piece (A) at the top was grooved to correspond to the sliding steel piece (B) riveted to the hacksaw frame. The saw (D) was of the same width as the keyseat, and was guided by slots in the pieces (F F). The proper depth was obtained when (B) was resting full on (A). This job was handled by one of the apprentices, and the keyseats were cut in a surprisingly short time. These keyseats were approximately 1-16 inch square.

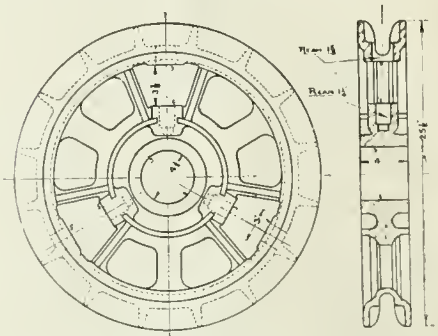


KEYSEATING MAGNETO GEARS.

DRILL PRESS BORING JOB.

D. O. Barrett.

THE drawing shows a sheave wheel used on a gasoline driven traction engine. A chain drive is used, the chain being of the round link variety or better known as log chain. The material is a steel casting, and the sheave is arranged



DRILL PRESS BORING JOB.

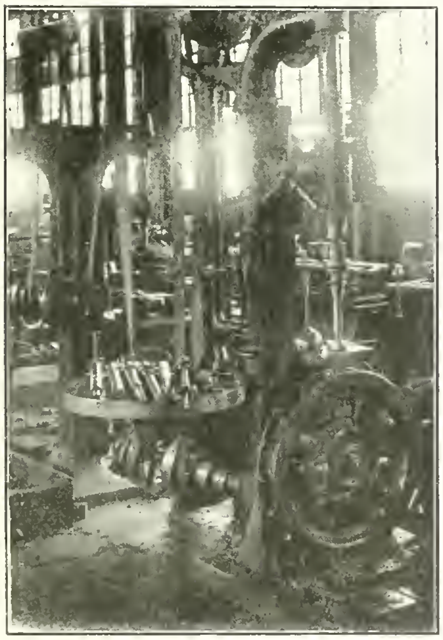
to carry three bevel pinions which revolve on pins held stationary in the sheave. These pinions mesh with gears on either side and form the differential.

The centre hole was first bored and faced on a lathe, and the boring of the holes and the facing done on the drill press as shown in the photograph. The various tools are shown on the table. The casting holding the sheave on the press table carries an indexing fixture with three positions and corresponding clamps. A stop is provided for one of the arms as shown at the left of the upper bushing, and a set screw at the bot-

tom forces over another arm to keep in proper contact. The three outer clamps are arranged with slots so as to be readily removable.

The holes in the casting were all cored and were exceedingly hard on the first drill, due to the large amount of sand on the surface. A long slip bushing was provided at the top reaching as far as possible into the groove. It will be noticed that two of the holes cut into the teeth on either side which made these particularly hard to start.

The tool second from the left shows the type first used. These were shells fluted helically and driven by a pin in a slot. It was found, however, that, in starting the holes where the tools would cut into the teeth at the sides, either these driving pins would be sheared off or else the cutters would be split. Four fluted drills with straight cutting teeth were then adopted as shown and proved



DRILL PRESS BORING JOB.

very satisfactory. The drills were of high-speed steel inserted in casehardened shanks, pinned and the whole arrangement ground. These gave no trouble and were thereafter used on all jobs of a similar nature. Two cuts were taken and the holes then reamed with an ordinary shell reamer. For the bottom hole a bushing was inserted in the holding fixture and an ordinary drill first run down, these holes not going entirely through. It was then finished as before.

In facing, the hardened bar fitted both of the previously finished holes. The first facer was provided with a serrated edge for breaking up the scale, and the surfaces were then finished with a flat tool. This job was a particularly hard one to handle owing both to the material and the shape of the piece, and had formerly been done outside, but the tools shown produced these accurately and no trouble was experienced with any of them. The total time for the drill press operations was about forty-five minutes, somewhat less than the time in which they had been done outside on a different type of machine.

WOODS FOR MAKING PATTERNS.

IN an investigation with a view to determining the relative merits of the different woods employed for pattern-making purposes, it was discovered that three kinds are chiefly employed—white pine, cherry and mahogany. White pine has always been used primarily in the manufacture of patterns, and still furnishes the principal supply of material for this purpose. Owing to the high price of number one shop and better white pine, which are the grades employed for patternmaking, California sugar pine is substituted to a considerable extent in patternmaking shops where large castings are made.

Sugar pine is regarded as the best substitute existing for white pine, but is not as satisfactory, for the reason that the tiny "sugar streaks" in this wood are prone to ooze resin, even through the varnish finish, which often results in a rough casting. However, by the employment of a heavy coat of varnish, this deficiency of the wood is not difficult to eliminate. While both white pine and sugar pine are inferior to cherry and mahogany, their lower price makes them more generally employed for patternmaking purposes. It has been estimated that patterns made in cherry and mahogany can be used several thousand times, whereas a softwood pattern would endure only about one quarter as long a period.

Constant use will wear off the sharp edges that are all-important in the forming of an accurate mold. When this occurs the usual remedy is to chamfer down the blunted corners and set in duplicates of cherry or mahogany. In core-boxes, it is a common practice to glue a hardwood veneer over the pine. Small or delicate patterns liable to be subjected to unusual wear are always made of hard-woods. The larger patterns, such as gear wheels, have their teeth made of hardwood, and the framework of pine.

Generally speaking, any wood that tends to either shrink or swell is poor material for patternmaking. Experience has shown that pine will shrink considerably in width, and will also expand materially when placed in contact with the moist core sand. This latter objection, however, has largely been overcome by varnishing.—Hardwood Record.

C.P.R. CONSTRUCTION.

A TOTAL of 1,700 miles of railway has been under construction during this season by the C.P.R., according to statements made by J. G. Sullivan, chief engineer of the western lines of the company, who has returned to Winnipeg from an extended tour of the work being undertaken. The amount of material which has been handled by the construction department of the company has been more than was moved during any period in the building of the Panama Canal, and represents no less than 30,000,000 cubic yards.

WOOD-USING INDUSTRIES.

ACCORDING to a bulletin obtainable from the Forestry Branch, Ottawa, 807,456,000 feet, board measure, of wood were used by thirty-eight different industries in the manufacture of all sorts of finished products, from spools to ships. The value of the wood so used, as purchased in the rough, represented a total of $19,161,384, and the capital engaged in these industries (which do not include sawmills, etc.), together with the labor engaged in the manufacture of these finished products, represents a very important economic asset to the resources of the Province of Ontario.

Thirty-four different kinds of wood were used, chief of which was pine, representing 21.7 per cent. of the total, and costing, on the average, $25.60 per thousand feet, board measure. Good, clear, white pine, however, is becoming comparatively scarce, and it is being increasingly substituted by spruce, which costs little more than half as much, being one of the cheapest woods on the market. It is significant to note that only six native species were purchased entirely within the Province, considerably over $5,000,000 being paid for imported wood.

The bulletin contains forty-three tables, containing summarized and detailed information regarding the quantity, value, kind, and source of supply of the woods used in each industry. Short descriptions of each species, with a list of their uses, are also included and suggestions are made as to the utilization of waste, while the appendix contains a classified directory of all the manufacturers.

The Dominion Iron & Steel Co. are filling an order for upwards of 15,000 tons of reinforced rods for the Welland Canal, which will keep the hands in that department busy for weeks to come. They expect to receive a big order for reinforced concrete material from the firm of Foley Bros., Welch & Stewart, who were recently awarded large contracts in connection with the Government railway and deep water terminals under construction at Halifax.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same, direct reliable answers. Catch questions will be avoided. The knowledge of simple addition, subtraction, multiplication and division of decimals, will be found a most useful companion study, and should not be overlooked.

Question.—The driving pulley on a shaft is 42 in. diameter and makes 20 revolutions per minute. How many revolutions per minute will the driven pulley make if its diameter is 3 ft.?

Answer.—Multiply the diameter of the driving pulley by its revolutions per minute, and divide the result by the diameter of the driven pulley. The pulley diameters must be both taken as feet or inches. Example:

$$\frac{42\times20}{36} \text{ or } \frac{42\times20}{12\times3} = 23.33 \text{ R. P. M.}$$

• • •

Question.—The wheels of a bicycle are 28 inches in diameter. The sprocket wheel connected with the pedals has 18 sprockets; the one connected with the wheel has 8 sprockets. How many miles an hour does the rider make if the pedals revolve 120 times to a minute?

Answer.—Multiply the pedal revolutions per minute by 60 to get revolutions per hour; multiply this result by the number of teeth in the pedal sprocket wheel and by the circumference in inches of the rear running wheel; then divide by the number of teeth on the sprocket attached to the latter and by 63360 the number of inches in a mile. Thus:

$$\frac{120\times60\times18\times28\times3.1416}{8\times63360} = 22.49 \text{ miles}$$

per hour.

• • •

Question.—A gear has 25 teeth and its diametral pitch is 16. What is its pitch diameter?

Answer.—The pitch diameter is found by multiplying 3.1416 by 25 and dividing the result by the diametral pitch 16 and by 3.1416, thus:

$$\frac{3.1416\times25}{16\times3.1416} = 1.5625$$

inches pitch circle diameter.

The circular pitch is found by dividing 3.1416 by the diametral pitch 16, thus

$$\frac{3.1416}{16} = .19635 \text{ inches circular}$$

pitch.

It will be noted that this last formula accounts for the first figures on the upper and lower lines of the first formula. The figure 25 on same formula is the number of teeth given; this multiplied by the circular pitch found, makes the pitch circle circumference. The divisor 3.1416 is used to bring the pitch circle circumference to pitch circle diameter.

Question.—The diameter of a piece that is being turned is 2 in. If the piece makes 2,500 revolutions per minute, what is the cutting speed?

Answer.—Cutting speed is always rated and spoken of in terms of feet per minute, therefore as the piece is being turned in amount equal to the length of its circumference, that length in feet wants to be first known.

$$\frac{2\times3.1416}{12} = .5236 \text{ feet per revolution.}$$

$2500\times.5236 = 1309$ ft. per minute, or

$$\frac{2\times3.1416\times2500}{12} = 1309 \text{ ft. per minute}$$

cutting speed.

• • •

Question.—The milling machine counter-shaft pulleys driven from a line shaft are 14 inches in diameter and are to run 100, 200 and 150 r.p.m. respectively. Find the diameters of pulleys for the line shaft running at 200 r.p.m.

Answer. $\frac{14\times100}{200} = 7$ inches diameter.

$$\frac{14\times200}{200} = 14 \text{ inches diameter}$$

$$\frac{14\times150}{200} = 10\tfrac{1}{2} \text{ inches diameter of}$$

line shaft pulleys respectively.

• • •

Question.—How many revolutions per minute ought a piece of cast iron, 3 inches in diameter be allowed to make if the cutting speed is usually 40 feet per minute?

Answer.—Bring the cutting speed to inches by multiplying 40×12 which will give 480. This divided by 3×3.1416, the circumference of 3 inch diameter, will give 50.9 revolutions per minute.

$$\frac{40\times12}{3\times3.1416} = 50.9.$$

By keeping the cutting speed in feet, the statement of the formula to get the same result would be

$$40\div\frac{3\times3.1416}{12} = 50.9 \text{ r.p.m.}$$

• • •

Question.—A certain grindstone will stand a surface or rim speed of 800 ft. per minute. At how many r.p.m. could it be run if its diameter were 4 ft. 8 in.?

Answer.—Divide 800 by the circumference in feet of the 4 feet 8 inches diameter grindstone.

$$\frac{800}{4.66\times3.1416} = 54.6 \text{ r.p.m.}$$

• • •

Question.—In a double butt strap joint, the outer butt strap is usually made narrower than the inner. Give the reason why?

Answer.—It assures a good caulking edge on the outer strap, free from liability to "spring" between the rivets, which are close pitched.

• • •

Question.—From what part of the joint do we reckon the strength of plate left between rivet holes, in a treble riveted double butt strap joint?

Answer.—From between rivet holes on the outer and widest pitch longitudinally.

• • •

Question.—What is meant by single and double shear, as applied to rivets?

Answer.—Single shear means that the rivet has only got to cut or shear through once before the joint gives out. Double shear means that the rivet has got to cut or shear through twice before the joint gives out.

• • •

Question.—Give an example of single shear rivets and double shear rivets.

Answer.—The rivets in a lap joint are in a single shear. Those in a double butt strap joint are in double shear, in all cases of their passing through both butt straps. Where the outer butt strap is narrower than the inner, the outer row of rivets is in single shear, because they pass through the shell and inner strap only.

• • •

Question.—Calculate what horse-power may be safely transmitted by a 16-inch double leather belt running on an engine fly-wheel 14 feet in diameter, and making 80 revolutions per minute.

Answer.—A safe working stress for single leather belting is 45 pounds per inch of width, and for double belting 75 pounds per inch of width. The horse-power transmitted will be the total stress on the driving side of belt multiplied by the velocity of belt in feet per minute and divided by 33,000.

Total stress is $75\times16 = 1200$ pounds.

Velocity of belt is $3.1416\times14\times80 = 3518.6$ feet per minute.

Horse power transmitted is

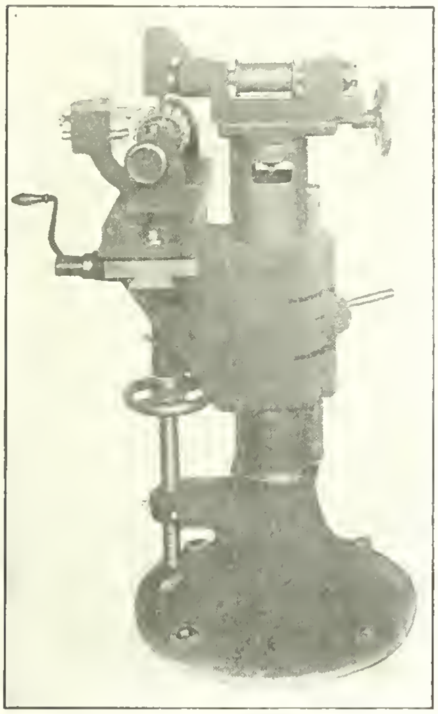
$$\frac{1200\times3518.6}{33{,}000} = 128, \text{ nearly.}$$

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

HOB AND CUTTER GRINDER.

THE machine which we briefly describe and illustrate was designed especially for sharpening hobs and radially relieved cutters. It is provided with a knee capable of vertical adjustment, with a swivelling table on same, also for adjustment where angular



HOB AND CUTTER GRINDER.

grinding is necessary, and is equipped with a rigid and substantial arm for holding an indexing finger furnished with screw adjustment.

The wheel is mounted on the spindle in a cross slide, which has adjustment for different diameters of work. The maximum capacity of this grinder is as follows:—Swing, 8 in.; length on centre, 13 in.; travel, 12. The total weight is approximately 700 pounds.

The Lees-Bradner Co., Cleveland, Ohio, are the builders of this hob and cutter grinder.

500 TON INVERTED HYDRAULIC PRESS.

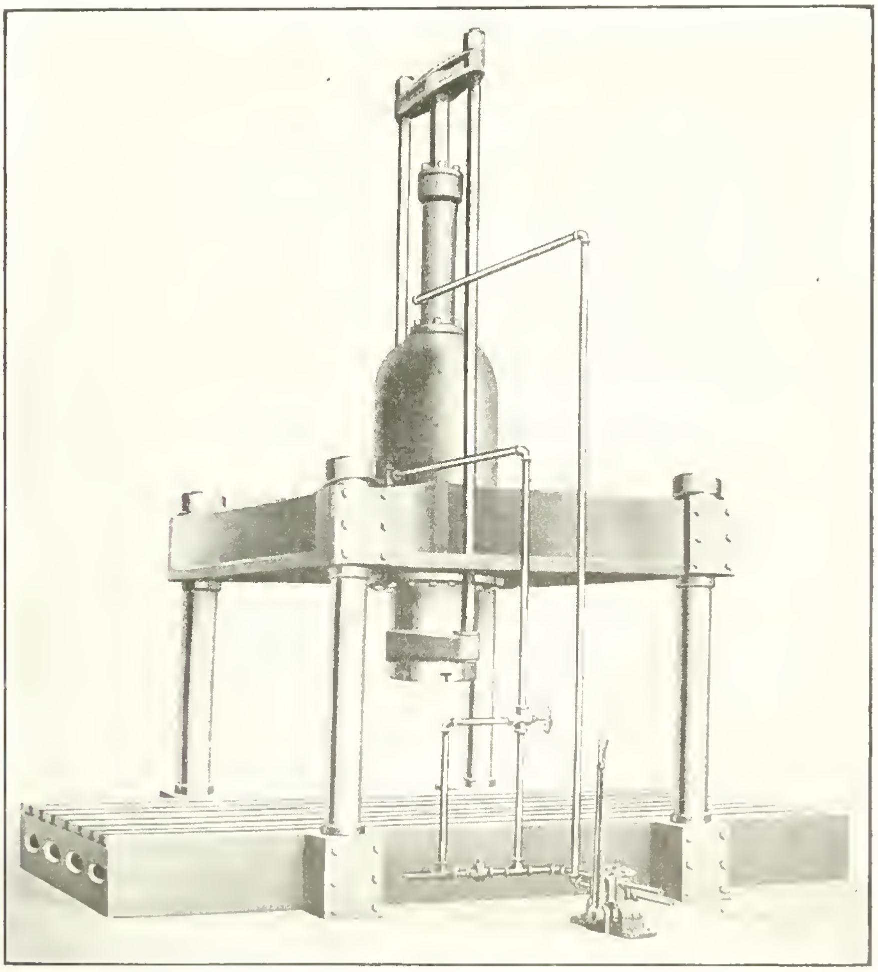
THE press illustrated was primarily designed for foundry use in the straightening of steel castings, but it can be used for other heavy straightening work, such as is often necessary in large industrial plants. The press was designed and built by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

The machine is hydraulically operated, and is capable of producing high degree pressure with great accuracy and speed. By opening a valve, the ram by its own weight drops to the work. This action causes the hydraulic cylinder to fill from the surge tank, and, therefore, the action of the pump obtains high pressure quickly, as the pump services are not required to fill the cylinder. When the stock has been straightened, the pressure ram is returned to any predetermined point of its run by the action of the pump pressure working through a return ram operated in an auxiliary or pull-back cylinder.

By merely shifting the lever of a double acting operating valve the pressure is applied to either the pressure ram or return ram, and permits the fluid to return to the surge tank. This surge tank is also used as a pump reservoir. As soon as the pressure ram has returned high enough to admit the work, the valve lever may be thrown into a neutral position, which holds the ram stationary until the operator is ready to apply the pressure. This method of operating saves a needless movement of the ram in both directions, thus economizing on time, labor, power and saving the wear on packings.

The working capacity of this press is 500 tons. The pressure bed is 6 feet wide and 12½ feet long, while the daylight or working space is 40 inches. The ram has a diameter of 20 inches, with a run of 24 inches.

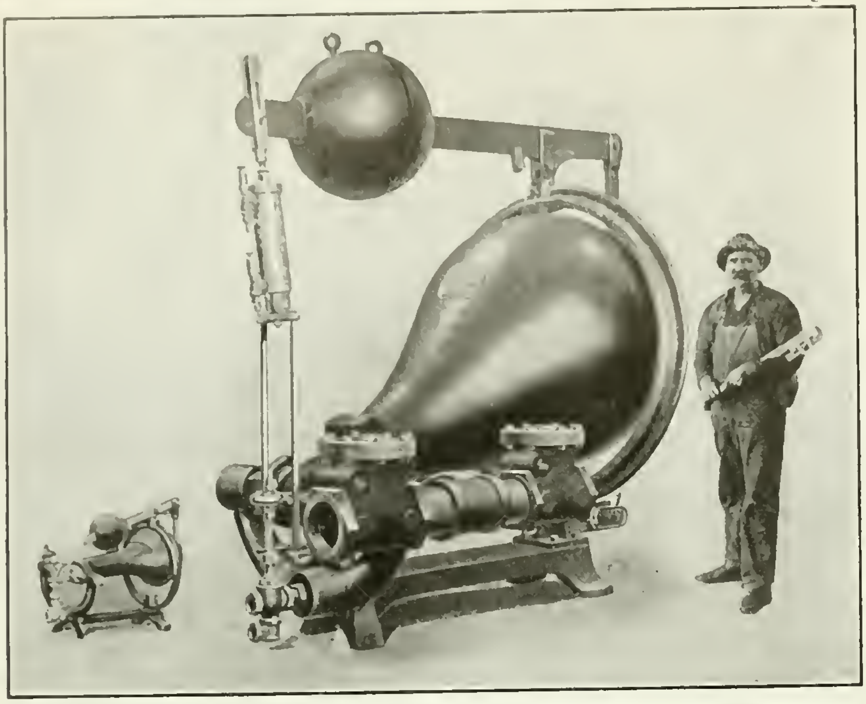
The press is built strong and rigid, and is capable of giving long and hard service, steel being used in its construction throughout. The strain rods are 5½ inches in diameter, and are made of forged steel. The pressure ram is faced with an open hearth steel plate, which has tee slots, to which pressure blocks may be attached for various requirements.



500 TON INVERTED HYDRAULIC PRESS.

THE LARGEST STEAM TRAP IN CANADA.

THE illustration herewith shows the largest steam trap that has yet been installed in Canada. This huge Bundy trap was recently supplied by H. L. Peiler & Co., Montreal, to the Quebec and St. Maurice Industrial Co. at La Tuque, P.Q.



THE LARGEST STEAM TRAP IN CANADA.

All the high pressure drips in this large pulp plant are returned to a closed receiver, and then go back to the boiler through the return trap. The trap has 4-inch inlet and outlet connections, and returns 50,000 lbs. of water per hour to the boilers, handling nearly half a ton of water at each operation.

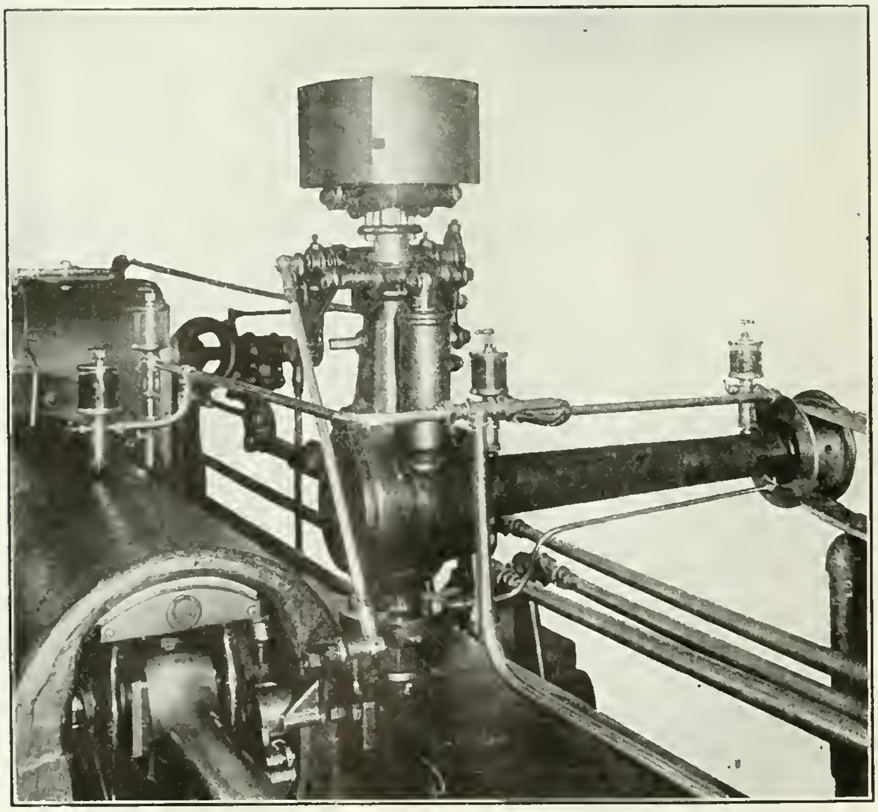
The shipping weight was 3.200 lbs, and the trap stands 6 ft. 6 in. in height. In spite of the great weight, the adjustment of the dash pot is so sensitive that the valve closes with absolutely no jar.

RICE AND SARGENT ENGINE STOP MOTION.

THE stop motion described in this article is from the designs of Mr. J. W. Sargent, Providence, R.I., and the sale of the apparatus is controlled in Canada by the International Engineering Works, Ltd., Amherst, N.S. The arrangement, as its name implies, is a safety device usually attached to the governor so that, when the engine exceeds a certain speed, the valve gear will be moved to approach zero cut off position.

The Sargent stop motion is operated by an inertia weight carried on the engine crosshead. Normally, this weight is held back against the stop by an adjustable spring, and remains quiet in relation to the crosshead, but when the engine exceeds about 5 or 10 per cent. of the normal speed, the inertia of the weight overcomes the spring at the end of the engine stroke, causing the weight to move forward from the crosshead about ⅜ of an inch and strike a hammer blow against a lever pivoted to the bed plate. This blow releases a latch and allows the valve gear to be moved up by a spring to zero cut off position, corresponding to the highest travel of the governor. No attention is required when shutting down the engine or when starting it up, and the full movement of the governor weights is available for useful work. The apparatus may be tested at any time when the load is off the engine by pulling down on the levers to speed the engine up to the limit.

When it is desired to use push-buttons for stopping the engine from distant points, a separate electrical attachment is used whereby a weight falls and strikes a blow on the latch mechanism to release it. This stop motion may also be used in connection with the throttle valve to release a latch or toggle, and allow the valve to close promptly. When so used, the stop weight is on the other end of the crosshead and operates at the head end of the stroke.



STOP MOTION LATCH ENGAGED; VALVE GEAR READY TO START UP.

The York Manufacturing Co., York, Pa., have recently made the following installations in Canada:—Manitoba Club, Winnipeg, one 4-ton vertical single-acting belt driven enclosed type refrigerating machine and high pressure side complete; R. H. Williams & Son, Ltd., Regina, Sask., one 2-ton vertical single-acting belt driven enclosed type refrigerating machine and high pressure side complete, also congealing tanks and direct expansion piping for storage tanks; Prince George Hotel, Toronto, ont., one 11-ton vertical single-acting steam driven enclosed type refrigerating machine and high pressure side complete.

PRATT & LETCHWORTH, BRANTFORD, ONT.

THE Pratt & Letchworth Co., Ltd., Brantford, Ont., makers of malleable iron castings, have considerably extended their large foundry this year, and installed much new equipment. This was necessitated by a fire which on April 7 demolished an addition which had only been made during the previous fall. As the plant was fully insured, the extension was rapidly replaced, and operations began again in June. The plant output is now 3,000 tons per month, which is an increase of 100 per cent.

Among the most important additions to the plant were a 250 x 175 ft. extension to the foundry at the west end, and a three-storey fireproof pattern storage building. The latter is a brick building, standing along north of the main building. One storey is used as a patternmaking and carpenter shop. There is also located in this building a chemists' laboratory for testing products and raw materials. An addition was also made to the shipping room, and preparations are being made for a machine shop, for which much of the equipment has already been purchased. A sprinkler system is being installed throughout the plant for fire protection.

Annealing Ovens.

To cope with the ever-increasing business which this firm enjoys, the equipment has recently been augmented at a cost of several thousand dollars. Six annealing ovens of the muffler type have been built by the firm themselves. These are used for annealing large castings, and differ from other ovens in that no pots are used for holding the product. When muffler ovens are used, the fire does not come in direct contact with the castings, as is the case on the pot ovens, consequently, the castings are easier to cool, and the type of oven is better suited to the work in every respect. The firm now operate twelve ovens of the muffler type, and ten pot ovens.

A considerable portion of the work secured by the Pratt & Letchworth Co. is for railway companies, car works, and agricultural implement firms, and is of a heavy description. Consideable small work is also done, the annealing for this being done in the pot ovens. A complete system of pyrometers has been installed on all ovens by the Price Electric Co., Buffalo, for regulating the heat.

Melting Furnaces.

Three new 20-ton melting furnaces of the firm's own manufacture have been installed in the new section of the foundry, and in convenient proximity to other new equipment. The charging of these is made easy by electric cranes, which travel the whole length of the foundry. The plant now contains seven furnaces, two of 15 tons and five of 20 tons capacity.

To make the plant more up-to-date and to facilitate work, a new craneway, running the whole length of the building, has been built by the Dominion Bridge Co., Montreal. On this operate two 5-ton electric cranes, supplied by the Whiting Foundry Equipment Co., Harvey, Ill.

The equipment for cleaning castings is not housed in one room, but is distributed throughout the building, the tumblers varying in size according to the size of casting turned out. Three batteries of new tumblers have been installed this year, which brings this equipment up to twelve large tumblers and twelve small ones. These were installed by the W. W. Sly Mfg. Co., Cleveland, O., who also had charge of the dust arrester system which has been connected to the tumblers throughout the building.

Other recent installations include a large Ingersoll-Rand air compressor of the Imperial type, which supplies air to the large number of moulding machines used in this plant, and to other equipment operated by air. Three blowers, made by Sheldon's, Limited, Galt, have been installed, two supplying the extra blast required for the new melting furnaces.

In the shipping room, an interesting addition is a conveyor leading from the floor to a platform on a level with the freight cars. This will carry a man with a wheelbarrow full of castings, and is a most efficient piece of machinery. The Company have also purchased an electric truck from the Canadian Auto Transportation Co., Welland, Ont., which conveys castings from the foundry to the shipping room.

A wooden coal trestle, with a capacity of 3,000 tons, has been built this year. Coal for the foundry is pushed up the incline in freight cars and unloaded.

Several new electric motors made by the Canadian General Electric Co. have been purchased for use on blowers, etc. Power for all motors is secured from the Western Counties Electric Co. The new machine shop now being built will be used for general repair work, and for making any new machinery required.

Paul J. Vernon, formerly with the International Harvester Co., Deering Works, Chicago, is superintendent of the plant.

Calgary, Alta.—The proposed municipal abattoir will cost approximately $125,000, of which the Dominion Government will provide $20,000 to $25,000.

NICKEL PLATING BRASS AND COPPER PARTS.

THE following formula for "nickel-plating" brass and copper parts is said to have proved very satisfactory. In using this method, the first step is to see that the parts to be plated are quite clean and free from grease. The work is then dipped in a saturated solution of bichloride of mercury, of else a paste is applied by rubbing. This treatment causes a film of mercury to be deposited on the work, and when this result has been obtained the pieces are dried in sawdust and then lacquered in the usual way. If a paste is found more convenient to use than the solution, it may be prepared by adding water to the bichloride of mercury to obtain the required consistency.

It is essential that the parts be lacquered after they have been plated in this way; otherwise the mercury will wear off in a short time. Bichloride of mercury may be prepared by allowing metallic mercury to dissolve in hydrochloric acid until the strength of the acid is used up. The liquid is then boiled off, leaving white crystals of bichloride of mercury in the vessel. Either a glass or earthenware vessel should be used to prepare the bichloride of mercury, as hydrochloric acid will act upon any metal vessel which may be used.

CRYSTALLISING PROPERTIES OF ELECTRO-DEPOSITED IRON.

IN a paper read before the Manchester Literary and Philosophical Society recently, on the "Crystallising Properties of Electro-deposited Iron," Professor H. C. H. Carpenter said that sheets of the metal, which were almost chemically pure, showed remarkable recrystallisation effects when heated and cooled above or below certain temperatures at which a molecular change takes place. In this way relatively enormous crystals are obtained in three seconds when a strip is cooled below a certain critical point.

The same heat treatment which produces coarse crystals in electric-deposited iron has the effect of refining wrought iron and very mild steel, provided they have been rendered coarsely crystalline by close annealing between 700 deg. and 800 deg. Cent. On the other hand, annealing at these temperatures has no effect in coarsening the structure of electrolytic iron refined by mechanical means at the ordinary temperature. In these respects, accordingly, the behavior of the latter is the precise opposite to that of wrought iron and mild steel. Professor Carpenter said that these observations were not only new as regards iron, but were unknown amongst metals of any kind.

INDUSTRIAL NOTABILITIES--No. 15

THOSE who have played against Graham Drinkwater at hockey, or have struggled with him in a business way, agree that he plays the game, but strenuously. That is probably why he is so popular in Montreal and wherever he is known, and a man would have to "go some" to keep up with him. He has recently been appointed vice-president and general sales manager of the Canadian Fairbanks-Morse Co., Ltd. It seems only a short time since he was studying science at McGill.

It is strange how some men can go whole-heartedly into sport, and yet come out top in the industrial world. Although Mr. Drinkwater's duties as general sales manager of this big organization are onerous, he still retains his connection with hockey, being a trustee of the Stanley Cup, the emblem of Canadian hockey supremacy. In his younger days, when a student at McGill University, he played for four years with the Victorias, and in two of these years won the hockey championship. He was also a footballer while at McGill.

Regarding his younger days we know little, except that he was born in Montreal, the son of Charles Drinkwater, for many years secretary of the Canadian Pacific Railway. In course of time he was sent to McGill, and graduated in mechanical engineering in

GRAHAM DRINKWATER.

1897. The following year he took a post-graduate course at the same university, in electricity and testing of materials, and in 1899 started out on his business career. The story of how he ended up with the Canadian Fairbanks-Morse Co. is interesting.

He started in the mining machinery business, working first in the shops of the Ingersoll Sargeant Drill Co., Easton, Pa., then with the James Cooper Mfg. Co., of Montreal, who made the above firm's machinery in Canada. Then followed a trip west to Rossland, B.C., as a salesman, returning in 1901 to take up the position of assistant superintendent in the factory of the James Cooper Mfg. Co.

In 1902 he was back in the States with the Rand Drill Co., but returned in 1903 to join the selling staff of the Canada Foundry Co., Toronto, remaining with that firm until 1905. It was in the following year that the Canadian Fairbanks Co. took him into the scale and railway department, and appointed him general manager of the Montreal office, in January, 1909. Two years later, the selling organization and Toronto factory were consolidated under the name of the Canadian Fairbanks-Morse Co., Ltd., and of this concern Mr. Drinkwater was elected vice-president and general sales manager in 1913. His friends predict greater things for him.

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H. V. TYRRELL - - - - - Business Manager

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Vol. XI.   JANUARY 1, 1914   No. 1

PRINCIPAL CONTENTS.

A NEW YEAR'S RESOLUTION.

MOST people resolve on New Year's Day to be different. If a man drinks too much whisky, on that day he resolves to cut it out. He may not succeed, but the attempt probably does him good. Manufacturers have been resolving lately not to buy stock until the first of the year. That may be good, too. It is hoped by other manufacturers that they will make another resolution to-day—that they are going to do better business this year than last, and begin to lay in supplies necessary for same. People who are convinced that they are going to have poor business, get in no supplies, and make no effort to secure it, will have their hopes fulfilled. The general feeling is that business will begin to-day on the upward curve. The chart has shown some sharp downward zig-zags this year. Prices, especially of steel, have done the same. Dealers tell us they have gone as low as they possibly can, and that the rise should take place early this month. Pessimists recommend a total suspension of business just because they believe business is bad. The optimist is the manufacturer who believes business is going to be good again this Spring, and is holding his men to cope with it. He is the man who will save the situation.

ANOTHER BIG CIVIC BUNGLE.

ON Saturday last, the intake pipe of the Montreal city waterworks broke, and for several days over half a million people have been without water, except for what was supplied by a private company. During this period, the citizens are being subjected to considerable inconvenience and suffering, especially in institutions like hospitals, where it was found impossible to heat the building because there was no water. In the middle of this trouble, a fire broke out in the central part of the city which was large enough to defy the firemen armed with extinguishers. Eventually it assumed such large proportions, the fire chief considered the advisability of confining it to one block by dynamiting the buildings around. A line of hose, a mile long, was, however, run to the river, and the fire got under control. A quarter of a million dollars damage was done to several manufacturing plants.

There was another serious side to this unfortunate mishap. Water, which is not valued at its true worth until it gets scarce, was absolutely necessary for the operation of certain industrial plants. On Monday morning, seven thousand employees of the Angus Shops of the C. P. R. were ordered to return home, as it was found impossible to run without water. Other large engineering works found difficulty in running, which goes to show how dependent is the mechanic for his daily bread on the men whom he elects to the City Council or the Board of Control.

There has been so much bungling in connection with the running of large Canadian cities within the past few years that the question of who shall govern the city has become a very serious one. Most of the conspicuous mistakes made in recent years have been in connection with waterworks, and in three important instances, with intake pipes, viz., at Toronto, Ottawa and Montreal. The layman is secure when dealing with petty by-laws, but when it comes to a big engineering problem like the water supply the people should see that a man who understands the business runs that department, uninfluenced.

Montreal once laughed at the idea of engaging expert advice on the waterworks. The experts will be called in now.

For the firm who can go ahead with the erection of their plant without resorting to the banks for funds, the present is an excellent opportunity. The price of brick and steel is as low as it has been for several years; labor is cheaper, and there is plenty of it. Another factor of importance is that deliveries are prompt, whereas eight months ago, plants were delayed several months in some cases, for want of steel.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Mont'l.	Tor'to.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3....	20 00	21 50
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3.......	20 00	22 00
Clarence, No. 3.........	20 50	21 00
Jarrow	.....	23 50
Glengarnock	......	26 00
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1........	19 40	18 35
Victoria, No. 2X	19 15	18 10
Victoria No. 2 Plain ..	18 90	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh.........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal......	2.10
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh.....	1.20
Steel hoops, Pittsburgh..........	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.20
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents..**
Steel bars	1.70
Structural shapes	1.80
Plates	1.80

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 65; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base..		$2 30
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOILER PLATES.

	Mont'l.	Tor'to.
Plates, ¼ in., 100 lbs...	$2 30	$2 20
Heads, per 100 lbs.......	2 55	2 55
Tank plates, 3-16 in......	2 60	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	9 00	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb off
Nuts, Hexagon, all sizes..	4½ per lb off
Fillister head	25 per cent.
Iron rivets	60, 10 p.c. off
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, bronze	70, 10, 7½, 10 p.c. off

Milled Products.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in...	75%
Finished Nuts over 1 in....	72%
Semi-Fin. Nuts up to 1 in..	72%
Semi-Fin. Nuts over 1 in...	72%
Studs.....................	65%

Discounts, f.o.b., Montreal.

OLD MATERIAL.

Dealers' Buying Prices.	Mont'l.	Tor'to.
Copper, light	$10 00	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings..	9 00	9 00
No. 1 wrought iron.....	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	13 00	12 00
New brass clippings....	8 50	8 75
No. 1 brass turnings....	7 25	7 50
Heavy lead	3 75	4 00
Tea lead	3 00	3 00
Scrap zinc	3 00	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$. 32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	.....	...	.....
10 in	3.50	....	.....	...	.....
10 in	4.12	....	.....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect from April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in. ..	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Mont'l.	Tor'to.
Lake copper, carload...	$16 00	$16 50
Electrolytic copper.....	15 25	16 00
Casting copper	15 10	15 60
Spelter	5 25	5 25
Tin	39 00	41 00
Lead	5 15	5 25
Antimony	8 50	8 50
Aluminum	21 00	19 50

SHEETS.

	Mont'l.	Tor'to.
Sheets, black, No. 28	$2.75	$2.70
Canada plates, ordinary, 52 sheets	2.75	2.75
Canada plates, all bright	4.00	4.15
Apollo brand, 10¾ oz. (American)	4.30	4.20
Queen's Head, 28 B.W...G.	4.40	4.40
Fleur-de-Lis, 28 B.W.G.	4.20	4.25
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.40	4.40

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.26
Benzine, per gal.	23½
Pure turpentine	0.60
Linseed oil, raw	0.60
Linseed oil, boiled	0.63
Plaster of Paris, per bbl.	2.10
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b. Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Dec. 29, 1913.—The natural quietness generally found in business circles at this time of the year has been increased this week by a very serious breakdown in the city water supply. At 5 p.m. on Christmas Day a rupture occurred in the main intake pipe about a mile from the low-level pumping station. As there is only the one intake, the result of the accident was a total stoppage of the supply. The high level reservoir is divided into two sections, one of which was empty at the time. Consequently the shortage of water during the past four days has been extremely serious. Fortunately, there have been no bad fires, but two or three small outbreaks have occurred which caused considerable anxiety. The Montreal Water and Power Co., who supply Westmount, Outremont and Maisonneuve, have come to the partial rescue of Montreal, and are supplying about 14,000,000 gallons a day. This, however, is only one-third of the city's normal requirements. Downtown office buildings are for the most part without a drop of water above the second floor, while up-town and in the north end conditions are even worse, householders being supplied from water carts sent out by the City Council. For the most part factories, though greatly inconvenienced, have managed to keep running, except those situated on the higher levels of the city. The Angus shops of the C.P.R. have practically had to close down altogether, the only men now working being those engaged on special jobs. The Company have their own power plant, but owing to the scarcity of water can only generate about 600 horse-power at present. The Point St. Charles shops of the Grand Trunk Railway, being equipped with their own pumping plant, are not affected by the accident. Officials at the City Hall talk of a renewal of the service on December 30 or 31; but this is generally considered to be a highly optimistic estimate.

There has been very little business done in machinery this week, and the same is true of pig iron, steel and other metals. Most firms are busy taking stock.

A Federal charter has just been granted to the Caughnawaga Light, Heat and Power Company, with a capital of $50,000, and headquarters in the Village of Caughnawaga, near Montreal.

The general powers of an electric light and power company are granted to the concern, of which the provisional directors are Frank M. Jacobs and Jacques Curotte, merchants, of Caughnawaga; Paul Theoret, real estate agent; Anselme Deguire, advocate, and Edgar Monette, electrician, Montreal.

Toronto, Ont., Dec. 30, 1913.—To-morrow is the last day of the year, and the next is January 1. Judging from the amount of business that has been deferred until after January 1, that day should see a new lease of life in matters industrial. Price seems to be no inducement to manufacturers to purchase stocks before the new year. Dealers insist that prices cannot go lower, and that now is the time to buy. Mills are closing down rather than sell at lower prices, and production is curtailed from about December 20 to the first week in January. Tenders for finished products are being returned, with repeated demands for lower prices.

Those with rose-colored spectacles are contemplating the material that will be required for Ottawa's big waterworks, tenders for steel to supply which will be called early in February. They point to the Welland Canal, the operations of the Hydro-Electric Commission, who are just preparing for much radial work, and that at Port Stanley. This will tide over the serious part of the winter.

All the steel mills are offering quick shipments—from two to three weeks. They have contracts, but manufacturers are not ready to specify against them. Mill business from Canada is practically nil; warehouse is very fair. No salesmen are out on the road.

Machine Tools.

The Canadian Fairbanks-Morse Co. report about twice as much business for December as for any other two months of the year. The future in machine tools should be better. Manufacturers are realizing that the worst is over, and are looking for an opening up. This does not give better results, but the feeling in the market is much better.

Metals.

Business in metals will certainly not recover until well on in January. Prices remain practically the same. The demand for aluminum is brisk for this time of the year. The demand comes mainly from automobile manufacturers, whereas the wants of electrical concerns are small. The Hydro-Electric Commission should be in the market soon for 400 tons.

WATER FAMINE IN MONTREAL.

A SERIOUS break in Montreal's only intake pipe occurred on the afternoon of Christmas Day, which put the low level pumping station out of commission and resulted in a very serious shortage of water for several days all over the city. The intake is a reinforced concrete horseshoe-shaped pipe, about 9 ft. maximum diameter, and the break, which occurred at a point about a mile from the pumping station, was some 60 feet in length. At the time of writing, repairs are being rushed by the insertion of a steel tube inside the concrete aqueduct at the point of rupture, and it is hoped that pumping will be resumed by January 1. General opinion, however, regards this estimate as extremely optimistic. At the time of the calamity the upper level reservoir was only half full, and but for the help of the Montreal Water and Power Co., who were able to supply about 14,000,000 gallons daily, the city at the end of 24 hours would have been absolutely without water.

Montreal normally uses 42,000,000 gallons each day, and the breakage caused very real inconvenience, espe-

cially in the uptown district. Many people were compelled to get a supply in pails from water carts sent round by the Corporation.

Westmount, Maisonneuve and Outremont obtain their water supply from the Montreal Water and Power Company, and were consequently unaffected.

INDUSTRIAL ACCIDENTS DURING 1912.

THE toll of death from industrial accidents throughout Canada during the year 1912, as shown in a report just published, involved no less than 1,220 workmen, while 5,780 received serious injuries. Thus, 7,000 workers in Canada's industrial army met with fatal or serious accidents while in the discharge of their duty during the twelve months.

Railways and Metal Trades Worst.

An analysis of the record of accidents, as made by the Labor Department, shows that the railway services and the metal trades are by far the most hazardous employments. On Canadian steam railways, 332 employes were killed during the year, and 1,831 were injured, a somewhat startling total. In addition to that there were 152 men killed in railway construction work, and 111 injured. In the metal trades 103 men were killed and 1,326 were injured.

Navigation Comparatively Safe.

Navigation is comparatively a safe calling. The total number of fatalities among those employed in navigation last year was 69, and non-fatal accidents totalled only 62.

In the building trades, the fatal accidents totalled 90, and non-fatal accidents 298. The collapse of scaffolds, etc., a preventible cause, accounted for 71 of the accidents to workmen in the building trades.

Classes of Railway Casualties.

In railway service, collisions caused 55 deaths and 174 non-fatal injuries to railway men. There were 91 killed and 104 injured through being run over by trains or locomotives. Derailments caused 25 deaths and 115 non-fatal accidents.

Dynamite explosions killed 50 men and seriously injured 37 others employed in railway construction, while 19 were killed and 28 injured through falling material.

Public Employees Suffer.

The list of fatalities and serious injuries among public employees indicates that the duty of keeping the peace, fighting fires, etc., is attended with considerable risk of life and limb. Fifteen public employees were killed and 266 seriously injured last year while on duty. Four were fatally shot while making an arrest. One fireman was killed and 31 were injured by being thrown from fire apparatus, and 27 were injured through collisions with street cars, etc. Curiously enough two accidents are put down to "frozen while fighting fires." Street cleaners, who to the casual observer, always seem to be in imminent peril of sudden death, apparently bear charmed lives. In the list of accidents to public employees only two are ascribed to the running down of street cleaners by street cars or vehicles.

The Labor Department does not claim to have secured a complete list of all industrial accidents during the year, but the record is as thorough and accurate as a careful tabulation of press reports and of Provincial Government Statistics will allow.

INTERESTING EXPERIMENTS.

EXPERIMENTS have been carried out to ascertain the danger from electric shock in directing a stream of water on a high-tension electric line. The resistance of a stream of water between the nozzle of a hose and a 12 ft. length of No. 6 copper wire was measured. Energy was obtained from a 250,000-volt 50-kilowatt transformer, with the middle point connected by a low-reading ammeter to earth and one terminal connected to the line. Variations of frequency between 45 and 60 cycles with 20,000 volts showed no appreciable reactance of the stream; resistance was calculated from current and voltage readings. The resistance of the stream rose with increase of water pressure, being slight for 6 ft. to 10 ft. lengths of streams, but marked for 15 ft.

With a 1 1/8 in. nozzle for 5,000 and 30,000 volts, critical lengths of stream were found up to which the resistance had a gradual increase, these being 17 ft. for a 1⅛ in. nozzle, and 20 ft. for a 1½ in. With a stream length of 15 ft. on a 50,000-volt line, a resistance of about 20,000 ohms water path was obtained, giving a current of about 0.25 amp. This would give the holder of the nozzle a severe shock and might be dangerous. With a stream length of 20 ft. for a 1⅛ in. nozzle, or 2_ ft. for a 1½ in. nozzle, the resistance was 800,000 ohms. This might be painful but practically not dangerous. The resistance of the body, being relatively low, is neglected.

The fact that a nozzle is earthed through the stream of water in the hose was not found to eliminate danger to the nozzle holder. The resistance of this path from nozzle to earth, through the water in the hose when the latter was thoroughly insulated from earth, was found to be about 150,000 ohms per 100 ft., which could not be depended upon to shunt much of the current from the man holding the nozzle.

SHERBROOKE IRON WORKS, LTD.

THE Sherbrooke Iron Works, Ltd., who have been established since 1887, are among the many firms who have erected new plants during 1913. Well and favorably known during the past quarter of a century as builders of tank work, sawmill machinery, pulp mill and mining machinery, they had during the past few years found their old premises becoming increasingly congested and inconvenient owing to the rapidly growing volume of their business. A new site was therefore purchased in the north-west quarter of the city, and the erection of a modern plant commenced forthwith. The first work from the new shop was turned out in May last. In addition to all their former lines, the firm are now taking up the fabrication of structural steel work and highway bridges, the new plant including a shop especially designed for this class of work.

The new site is served by a private siding into the yard and shops from the C.P.R., and has connections with the Grand Trunk, Quebec Central, and Boston & Maine Railways. On it have been erected two commodious buildings, which accommodate offices, machine shop, blacksmith shop, pattern shop, foundry and structural shop.

The first building measures 140 feet by 95 feet and forms the machine shop. It is divided into the usual three bays and is excellently lighted and equipped. Part of it is partitioned off to form handsome offices for the management and the accounting department, above these being a well appointed drawing office. A portion of one of the side bays is also divided off for use as a pattern shop. In an annex outside the main shop there is a small blacksmith department.

The second building is 220 feet by 95 feet ,and is divided by a transverse partition into two sections. The first of these is 120 feet long and forms the foundry. It is divided into the usual three bays, the main floor being served by a Royce 10-ton travelling crane of the 3-motor type. The foundry is well laid out and has excellent natural lighting.. The second section of this building forms the structural shop. This measures 100 feet by 95 feet, and contains the usual equipment of punches, shears, riveters, etc. Among these there is an all-steel Pells shear.

All the shops are heated by direct radiation and lighted by tungsten lamps.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Guelph, Ont.—A small fire occurred on Dec. 22 in the japanning room of Griffin's foundry.

Edmonton, Alta. — Plans are being made to enlarge the factory of the Winnipeg Ceiling & Roofing Co.

Montreal, Que.— The W. W. Butler Co., Ltd., recently incorporated, adivse that they will not require machine tools.

Goderich, Ont.— The American Road Machine Co. of Canada, Ltd., are not ready to discuss machine tools for their new plant.

Beaverton, Ont.—The machine shop and foundry, which has been operating for forty years, has been closed indefinitely.

Toronto, Ont.—Roden Bros., 99 King West, have awarded contracts to build a plant for the manufacture of jewellry on Wilton Ave.

Montreal, Que.—The Deebul Tools, Ltd., the Auto and Garage Co., and several manufacturing firms were burned out on Monday, December 29. Total loss, $285,000.

Niagara Falls, Ont.—The Dominion Chain Co., Ltd., Ellen Avenue, are negotiating for a site on which to erect a factory for the manufacture of various kinds of chains.

P. L. Robertson Mfg. Co., Milton, Ont.—The amount of business done during 1912 doubled that of 1911, and up to the present the company has a 100 per cent. increase on that of 1912.

Sarnia, Ont.—Plans have been prepared for a two-storey machine shop of brick and steel to be erected by Henry Lougheed, 125 Front Street, who is receiving bids for the building and equipment.

Bedford, Que.—The Corey Needle Co. has sold out to the Excelsior Needle Co. of Torrington, Conn. The Corey Co. employed between 50 and 60 hands. It is understood that the new concern will enlarge the plant.

Midland, Ont.—The Midland Malleable Iron Co., Midland, Ont., has let contract to the Rauff Co., Milwaukee, Wis., for the erection of a concrete and brick foundry building, 83 x 503 ft., one storey, to cost $115,000.

Prince Albert, Sask.—H. C. Struchen, Minneapolis, Minn., has been granted a free site of ten acres on which he will erect a pulp and paper mill. He has been granted 1,500 h.p. from the city's plant at La Colle Falls.

Sarnia, Ont.—The Cleveland Foundry Co. advise that practically the entire equipment for their Sarnia plant will be shipped from Cleveland. No castings will be made at Sarnia, so all the machinery will be of the punch press line.

Quebec, Que.—The American Titanic Iron Co., Ltd., have been incorporated at Ottawa, capital $1,000,000, to manufacture and deal in iron, steel and all other metals. Incorporators: Simon N. Parent, Ottawa; Eugene Roberge, Lambton, Que., etc.

Woodstock, Ont. — The Wayne Oil Tank and Pump Co. are making good progress with their new building. There will be no foundry; merely a sheet metal working department and machine shops. They should be ready to instal machinery in February.

Montreal, Que.— Fraser & Chalmers of Canada, Ltd., have been incorporated at Ottawa, capital $100,000, to carry on business of manufacturers of mining machinery, at Montreal: Incorporators: John J. Creelman, Gilbert S. Stairs, etc., Montreal.

Bedford, Que. — Plans for the new plant of the Bedford Mfg. Co., makers of scythes, axes, etc., who were burned out a month ago, call for four buildings 150 x 50 ft. each, building to commence at once. The town will give a bonus of $12,000.

Sarnia, Oct.—The Sarnia Bridge Co. announces that on January 1 they will commence an extension to their plant, which will mean the increase of their working staff by about 50 men. The addition, which will occupy about seven acres of land, will be erected adjacent to the present plant. Recently the firm increased their capital.

Sarnia, Ont.—The steel work of the new Perfection Stove plant is completed. The steel was fabricated at Cleveland, and shipped here ready to be erected. The roof is being placed in position, and is made up of 2-inch pine sheeting covered with asbestos roofing. The floor will be of concrete, but will be covered with hardwood over its entire surface.

Coaticooke, Que.—The factory of the A. O. Norton Co., makers of lifting jacks, was destroyed by fire on December 28. The loss is considerable, but has not yet been definitely ascertained. It is only partly covered by insurance.

Welland, Ont.—A permit for the new factory building and office of the Electric Steel & Metals Co. was issued by the city engineers department last week. The building will be of concrete, steel and brick, and will cost $30,000. The Standard Steel Construction Co. have the contract.

Electrical

Winchester, Ont. — Hydro-Electric power was turned on Dec. 19.

Goderich, Ont.—The Hydro power was turned on here Sunday last.

Winnipeg, Man.—The Shipman Electric Co. suffered $18,000 loss by fire Dec. 19th.

London, Ont.—The street railway is now taking 1,000 h.p. Hydro power from the city.

Bridgden, Ont.—The village will spend $4,000 on the erection of an electric lighting plant.

Peterboro, Ont.—The city is spending $120,000 on a new power and lighting system.

Souris, Man. — The new civic light and power plant was opened by the Mayor, Saturday, Dec. 20.

Brigden, Ont.—This village will spend $4,000 for the purchase and erection of an electric lighting plant.

Wilkie, Sask. — The town will raise $30,000 for the extension and development of the electric light service.

Owen Sound, Ont.—The Council has decided to light the business section of the town with 100-c.p. tungsten lamps.

Forest, Ont. The town's first public utility was opened Dec. 23, being the new $20,000 electric light and power plant.

Cobalt, Ont.—The valve house of the Northern Ontario Ontario Power Co. was destroyed by fire Dec. 21. The loss is estimated at $1,000.

Sherbrooke, Que.—Two Miles Falls Water Power Co., has been incorporated with a capital of $500,000. Incorporators:—I. L. Lafleur, J. E. Roberge, O. E. Dorais.

Orangeville, Ont.—The Pine Light & Power Co. are making preparations to serve Dundalk, and are considering an extension to Grand Valley and Arthur, 28 miles distant from its plant.

Havelock, Ont.—At the coming municipal election, Havelock ratepayers will vote on a by-law to authorize the council to purchase a supply of electric power from the Hydro-Electric Commission.

Fort Francis, Ont.—Plans are underway for the development of the water-power situated north-east of the town, to furnishing hydro-electric power for the use of industries at a very low rate.

Stouffville, Ont.—On January 6 ratepayers will vote on a by-law to take over the electric light plant lately operated by Jonas Byer, and now by John Bartholomew, and for reconstructing the system.

Toronto, Ont.—The following towns in Ontario will vote on Hydro-Electric by-laws: — Strathroy, Kemptville, Havelock, Wallaceburg, Creemore, Sandwich, Tilbury, Chatham, Hanover, Williamsburg, Winchester Springs, and a group taking power from Eugenia Falls.

Edmonton, Alta. — The power plant superintendent is asking for an expenditure of nearly half a million dollars for new machinery and extensions to the plant. The following are his estimates for 1914: $614,000 for the general operation of the plant, and $210,000 for interest and sinking funds.

Wood-Working

Parry Sound, Ont. — The Thompson Boat Works was destroyed by fire Dec. 23rd.

Englehart, Ont.—West & Jackson will make an addition to their sawmill in the spring.

Trenton, Ont.—The Canada Creosoting Co., will go ahead with the construction of new buildings.

Richmond, Que.—S. E. Desmarais & Co.'s saw and grist mill was destroyed by fire December 23.

Watford, Ont.—The factory known as the Hastings Wagon Works has been permanently closed. The building has been taken over by Silverwoods, Ltd., of London, and is being remodeled, under the managership of L. R. Kennell, as an up-to-date creamery plant.

Goderich, Ont.—E. Bachelor has written the council stating that he intended to erect a factory for wood working purposes. He asks for a bonus.

Fort Francis, Ont.—The Fort Francis Sash and Door Factory will be considerably extended this year, in order to handle increased business.

Moose Jaw, Sask.—The T. G. Brown Co. have agreed to erect a sash and door factory 50x80 feet., two storeys, costing $10,000, and $6,000 for machinery. It will be ready Oct. 1, 1914.

Brantford, Ont.—The Brantford Piano Case Co., Ltd., have built foundations for a new plant. The directors are: M. S. Phelks, W. D. Schultz and Jos. Ruddy. This plant is 200 x 48 feet, main building, two stories, white brick. There will be a separate power house 36 x 86 feet, containing 180 h.p. high pressure boilers, and 150 h.p. engines, with all necessary equipment. The company will manufacture piano cases and back, trusses, pilasters, music cabinets, phonograph cabinets, piano benches, and high grade veneer stock.

General Industrial

Loveborn, Sask.—All the machinery in the newspaper plant was destroyed by fire last week. Mr. Hill, owner.

St. Mary's Ont.—The Thames Quarry Co., will erect a plant for the manufacture of cement, stone and brick.

Quebec, Que.— Tourigny & Marois, whose shoe plant was destroyed by fire recently, will rebuild either in Quebec or elsewhere.

Perth, Ont. — Fire destroyed the Scotch Line cheese and butter factory Dec. 21, causing a loss of $5,000, with $1,000 insurance.

Winnipeg, Man.— Plans have been prepared for rebuilding the malt house of the Canada Malting Co. The structure will be one storey, of brick.

Vancouver, B.C.—The Carhart Manufacturing Co., of Detroit, will establish a factory in Vancouver for the production of overalls, etc.

Sarnia, Ont.—The Stewart Jam Co. is considering an extension to the present accommodation, the improvements to cost about $15,000.

Sydney, N.S.—A group of local men have completed plans and estimates for the erection of a flour mill to be established on the old mill site on Anderson's point. The news is confirmed by H. C. Burchell of the Cement Co., who is interested in the venture.

Port Arthur, Ont. — T. H. Shields, West Hamilton, Ont., is contemplating the erection of a pottery here, if the clay in the district proves satisfactory.

Fort William, Ont.— The new plant of the Fort William Starch Works, Ltd., on Island No. 2, costing $300,000 is closed in, and should be operating by February.

Guelph, Ont.— An American concern has made the city a cash offer for the Morlock factory which will be used for manufacturing. Another concern will erect a $100,000 factory here.

Moose Jaw, Sask.—The city has executed an agreement with the Stewart Sheaf Loader Co., of Winnipeg, under which the Company agrees to build a warehouse to employ 20 men, next summer.

Berlin, Ont.— The bark mill, leach houses, tanning department, boiler house and tannery offices of the Breithaupt Tanning Co. were totally destroyed by fire Dec. 22. The plant will be rebuilt at once.

Bridgeburg, Ont.— L. A. Woodward, local manager of the Genesee Pure Food Co. has been appointed by his firm, the headquarters of which are in LeRoy, N.Y., to select a desirable location for a plant here.

Grand Forks, B.C.—The Grand Forks Canning Co. held their first annual meeting last week, and elected C. A. Wallace, president and managing director. Machinery for the new plant will be ordered immediately.

Vancouver, B.C.— A reorganization of the Ocean Falls Co. in amalgamation of Pacific Coast paper interests, will put the Ocean Falls pulp plant in active operation again, and in addition mean the building of a $3,000,000 paper mill.

Petrolea, Ont.—The Canadian Oil Refining Co. is building a new wax works. Several skilled mechanics have been brought from the United States to instal the machinery. It is estimated that the cost of the plant will be about $75,000.

Brantford, Ont. — The A. J. Reach Mfg. are putting up a very modern plant in Brantford to manufacture sporting goods. The A. J. Spaulding Co. have leased a building in Brantford for a year with the privilege of renewing, for manufacturing sporting goods.

Estevan, Sask.—A Mr. Welk was recently here looking at a site for a flour mill of 250 barreds capacity. He will require a site 250 x 120, for which he is prepared to pay a reasonable price, and will require concessions in the way of electric power.

Quebec, Que.—A syndicate, in which Col. B. A. Scott is interested, will erect a $4,000,000 pulp and paper mill, with power plant on the Saguenay River.

Vancouver, B.C.— Charles S. Meek, acting for the Royal Crown Soap Co. has purchased 66 feet on the corner of East Hastings and Carleton streets, which the Company will utilize in the building of a warehouse. Work on the construction of the soap factory in North Burnaby will proceed in a short time.

Sarnia, Ont.—It is reported that the new plant being erected here by the Imperial Oil Co. is for the manufacture of a new motor spirit. Excavations have begun for a battery of nine stills of 250 barrels' capacity each. Additional buildings will be put up for the purifying of the fuel, including condensers, agitators, sweeting stills, etc.

Building Notes

Vancouver, B.C.—The contract for new service wing and nurses' home for the General Hospital has been let to Booker, Campbell & Whipple, the amount of the contract being $199,921.

Regina, Sask.—The Consolidated Rubber Company will erect a $40,000 warehouse, 100 feet wide by 113 long, half to be left one storey high for the present, but the whole building to be set on a foundation to carry one of the best warehouses in the city.

Contracts Awarded

Milton, Ont. — The P. L. Robertson Mfg. Co. have received contracts for screws, etc., from several of the largest carriage, furniture and auto factories during the past few weeks, which will keep the factory working full time for the next eight months.

Toronto, Ont.—Acting on a principle of "City work for City men," the Board of Control has accepted a tender for the supply of cast iron pipes from Jan. 1 to Dec. 31 from a local firm in preference to a lower one from the Florence Iron Works of Philadelphia, Pa. The estimated cost will be in the neighborhood of $100,000, while the American foundry would provide the supply at a price cheaper by $2,400.

Calgary, Alta.—The City of Calgary, is meeting a great demand for space in the industrial building which it is proposed to erect in the near future. The plan calls for the erection of a modern factory building of eight or ten storeys, space in which is to be leased to small industries just establishing here. The new structure will contain every facility for the small manufacturer. Calgary is now becoming quite an important industrial city, and a number of small industries employing from ten to fifty hands are ready to begin operations as soon as the municipal factory building is completed. Many of the smaller manufacturers have not enough capital to undertake construction on their own account, and it is hoped the policy proposed will have the eventual effect of building up a large number of fine industries. The proposal originated with the Calgary Industrial Bureau, but has now been taken up enthusiastically by the city council. It is expected that a by-law for the appropriation of the sum required will be placed before the electors for their endorsement in the early future.

New Incorporations

New Ontario Pressed Brick Co., Ltd., incorporated at Toronto, capital $150,000, to manufacture building materials of all kinds, at Sudbury, Ont. Incorporators: Chester A. Durkee, Isaiah Proctor, etc., Sudbury.

Construction Supply Co., Ltd., incorporated at Toronto, capital $60,000, to carry on the business of general contractors and engineers, at Toronto. Incorporators: William Bain, Joseph Ellis, etc., Toronto.

The Dart Cycle Car Co., Ltd., incorporated at Toronto, capital $100,000, to manufacture, assemble, buy and sell cycle cars and power driven vehicles and parts thereof, at Toronto. Incorporators: Harry B. Smith, Frank M. Lorsh, etc. Toronto.

The Renfrew Molybdenum Mines, Ltd. incorporated at Toronto, capital $1,500,000, to acquire, own, lease and dig for ores, metals, and minerals, at Mount St. Patrick, Renfrew, Ont. Incorporators: Stanley T. Chown, John Geale, etc., Renfrew.

The Non-Nitro Explosives Co., Ltd., incorporated at Toronto, capital $180,000, to manufacture explosives, and the by-products thereof, at Toronto. Incorporators: Joseph J. Flint, Henry A. Hall, etc., Toronto.

The National Vending Machine Co., Ltd., incorporated at Toronto, capital $100,000, to manufacture, purchase or otherwise acquire and deal in vending machines, etc., at Toronto. Incorporators: Mark V. Packard, St. Louis, Mo.; Blanche C. Boyd, etc., Toronto.

Russell Jennings Mfg. Co., Ltd., incorporated at Ottawa, capital $50,000, to manufacture and deal in augers, auger bits, and all kinds of machinery, at St. Catharines, Ont. Incorporators: Arthur L. Jennings, Chester, Conn.; James K. Kernahan, etc., St. Catharines.

The Canadian Mantel and Refrigerator Co., Ltd., incorporated at Toronto, capital $100,000, to manufacture and deal in grates, mantels and refrigerators, at Hamilton. Incorporators: Henry D. Petrie, Henry G. Ogg, Wilfred W. Currier, etc., Hamilton.

Beaver Coal & Power Co., Ltd., incorporated at Ottawa, capital $1,000,000, to acquire mines, sell and deal in briquettes, coke, oil, shale, creosote, sulphate of ammonia, and all other metals, at Montreal, Que. Incorporators: Frederick H. Markey, Waldo W. Skinner, etc., Montreal.

The Connolly-Agnew Construction Co., incorporated at Toronto, capital $40,000, to engage in and carry on the business of contractors for the construction and installation of waterwork plants and systems at Toronto. Incorporators: John F. Connolly, Thomas C. Agnew, etc., Toronto.

The Caughnawaga Light, Heat and Power Co., Ltd., incorporated at Ottawa, capital $50,000, to carry on the business of an Electric Light Company in all its branches and to manufacture, sell and distribute light, heat and power for any purpose for which the same may be used, at Caughnawaga, Que. Incorporators: Frank Mc. Jacobs, Jacques Curotte, etc., Caughnawaga, Que.

Municipal

Regina, Sask.— The city is contemplating the erection of an abattoir.

Kingston, Ont.—The water mains are in a serious condition, and will be remedied.

Tottenham, Ont. — This village will spend $14,000 on the installation of a waterworks system.

Longueiul, Que.—The council of Montreal South, is contemplating taking water from Longueiul, Council.

Winnipeg, Man.—A booster pump for Fort Rouge, to raise the water pressure, is being reported on by the city engineer.

Galt, Ont. — The superintendent of waterworks has been authorized to order sufficient steel pipe to complete the trunk main.

Norwich, Ont.—J. W. Johnsten, M.O.H. for the Town of North Norwich,

recommends the erection of a township abattoir.

Preston, Ont.— Plans for a waterworks system are being prepared by H. Edgar, engineer. The estimated cost is $53,000.

Camrose, Man.— A flow of gas of half a million feet a day has been struck by the town, and will be used by several industries.

Sydney, N.S.— The fire commission contemplate the purchase of a motor combination fire truck. A 90 h.p. truck is recommended.

Medicine Hat, Alta.—In order to dispose of the garbage and rubbish of the city, the engineering department are making arrangements for installing an incinerator.

Calgary, Alta.—The city council has decided favorably on the submission of a by-law for $360,000 for the improvement of the plant and buildings of the Calgary exhibition.

Galt, Ont.—The water commission has decided to continue the laying of the trunk main through the town, and has ordered the superintendent to order more steel pipe.

The Pas, Man. — A by-law to raise $130,000 for completion and extension of waterworks and sewers and installing electric light plant was carried by a large majority.

St. Catharines, Ont. — The Ontario Board of Health has directed the city of St. Catharines to establish a filtering system in connection with the waterworks system; mechanical filtration of the gravity type being preferred.

Tenders

Ottawa, Ont.—The City of Ottawa, Canada, will open bids February 3 on 87 miles of 51 to 58 in. riveted steel pipe. The amount will exceed 50,000 tons.

Winnipeg, Man.—Tenders, addressed to the Chairman, Board of Control, will be received up to January 22, for the manufacture, delivery and erection in the power house at Point du Bois of one head gate and head gate lifting mechanism, including the necessary accessories. M. Peterson, secretary.

Ottawa, Ont. — Work is advancing rapidly on the new Welland Canal and Section 8 will be the next for which tenders will be called. This is the section next to Port Colborne, and will be an expensive cut, as it is through rock for the most part. Plans and specifications are now in preparation, and tenders will be called for during the winter.

Railways—Bridges

Quebec, Que.—The C.N.R. is negotiating for the purchase of the Quebec and Saguenay Railway.

Montreal, Que.— The Montreal Tramways Co. will extend its system along Van Horne Ave. to the city limits next spring.

Campbellford, Ont.—The proposal has been revived to build a railway between Cobourg and Havelock and take in Warkworth.

Iroquois, Ont.—The Township of Matilda will spend $6,000 on a bridge over the Petite Nation River. Eli Merkley, Reeve; J. J. Payne, clerk.

Toronto, Ont. — The Dundas street bridges, which have for a long time been recognized as one of the danger spots of the city, will be entirely re-constructed next year.

St. Catharines, Ont.—The C.N.R. intend completing the line from St. Catharines to Hamilton within three years, and the section from Hamilton to Toronto within five years.

Port Colborne, Ont. — Rumors have been prevalent in Bridgeburg this week, that the Boulevard Commission have definitely decided to extend a trolley line up the boulevard from Niagara Falls the coming spring.

Welland, Ont.— The Street Railway Company have decided to remove the rails from North Main Street and will not put down this extension until next spring. An extension of the franchise is to be asked for.

Ottawa, Ont.—The Calgary & Fernie Railway Co. will apply to Parliament for an Act extending the time for the construction of its authorized lines, and to change the head office of the company from Fernie to Calgary.

Barrie, Ont.—The first section of the Toronto, Barrie & Orillia Electric Railway to be built is the portion in this town. Work is to be begun by April next, and the line in the town will be finished by Sept. 1914.

St. John, N.B.—The petition of the Quebec Extension Railway Co. to construct a railway across the northern part of Maine, between the New Brunswick and Quebec boundaries, has been approved. The proposed road will extend from Caribou to a point above Megantic, a distance of 110 miles, and will be part of a projected railway from St. John, N.B., to Quebec.

Vancouver, B.C.— The Kettle Valley Railway Co. will apply for an extension of time for construction, also for the right to build a branch line from Otter Summit, by the most feasible route, to Aspen Grove mineral district, a distance not exceeding thirty miles.

Ottawa, Ont.— Application will be made to Parliament for an amendment to the Act incorporating the Lake Erie & Northern Railway Co., empowering it to increase its securities from $30,000 to $45,000 per mile, and to give it power to borrow money for construction work.

Penetanguishene, Ont. — The Mayor and Council of Penetanguishene are taking up the matter of procuring electric railway connection with the C.P.R. at Port McNichol, and are in correspondence with the Hydro-Electric Power Commission with a view to procuring estimates of cost and arranging details.

Regina, Sask.—Hon. J. A. Calder announces that actual work on the G.T.P. bridge over the South Saskatchewan river will be commenced immediately. The Government intends giving the company a further guarantee of $2,000 per mile, and in addition $1,300,000 to cover the cost of two railway bridges, one of which is on the line from Poung to Prince Albert.

Toronto, Ont.—The Harbor Commissioners have approved plans and specifications for improvements to be made at the mouth of the Don River and the construction of a lift bridge at Cherry street. The work will be done on day labor by the Harbor Board. It was announced by Secretary Lewis that the work will be commenced in April next. The improvements, including the bridge, will cost in the neighborhood of $294,000.

Trade Gossip

The Keeton Motor Car Co., Brantford, have increased their capital by $150,000.

The International Harvester Co. will run their plant full blast the first of the year, it is reported.

London, Ont.—It was said a few days ago that the London and Port Stanley Railway Commission will invite C. M. Eastman, Windsor, to become manager of the city's line when it is electrified.

The Swedish General Electric Ltd., until recently known as Kilmer, Pullen & Burnham, Ltd., Toronto, have been awarded the contract by the City of Calgary, for the supply of a motor generator set at $18,250.

The National Steel Car Co., Hamilton, has received a big order for steel cars from the Grand Trunk Pacific, Great Eastern, and Montreal & Southern Counties Railway Companies, and this will practically keep the entire staff running through the winter.

The Consumers' Rubber Tire Co., a new concern, which will establish its factory at St. Catharines, Ont., has applied to the Dominion Government for a transfer of a lease of 2,000,000 feet of water per day from the Welland Canal, granted to the H. Goodrich Co., which has decided not to locate in Canada.

The Union Carbide Co. of Canada, Welland, have purchased two De Laval 1,300 gallon per minute pumps, each to operate against 150 feet head, and two centrifugal sewage pumps for their plant. The Turbine Equipment Co., Toronto, the De Laval agents, will also supply all auxiliary equipment necessary for the installation of these pumps, including gasolene engines, etc. These engines will be used in case the electric power at any time is out of commission.

Personal

P. J. Stevens, factory superintendent for the Hoyt Metal Co., Toronto, has left for St. Louis and Chicago where he will visit several lead plants.

J. C. Stewart has been appointed manager of the Toronto Wire Nail & Tack Co., West Toronto, which has been acquired by the P. L. Robertson Mfg. Co., Milton, Ont.

H. E. Pawson, has been appointed electrical engineer for Prince Albert, Sask. He was formerly with the Phoenix Dynamo Co., of Bradford, Eng., and more recently with the Appalachian Power Co.

William J. Shaw, who has been engaged in promoting the International Tool Steel Company of Port Hope, the plant for which is in course of construction, died at 227 Leslie St., Toronto, December 29, aged 73.

P. L. Robertson, president and manager of the P. L. Robertson Screw Co., Milton, Ont., is at present in England completing the organization of the Recess Screw Co. under British patents. This will be one of the foreign branches of the Milton Co.

W. E. Davidson, secretary of the Pearson Mexican Corporations, having head offices in Toronto, which include the Mexican Light & Power Co., the Mexican Tramways Co. and the Mexican Northwestern Railway Co., died Christmas Day on a steamer in the Gulf of Mexico.

Arthur Grace, recently elected Commissioner of Public Works, Lethbridge, Alta., went there as engineer in charge of the construction of the Alberta Railway & Irrigation Co.'s irrigation works. He has had lengthy experience as an engineer in railway construction, and has had considerable civic experience in the construction of waterworks. He is an authority on gravity systems.

Arthur Reid, recently elected Commissioner of Public Utilities, at Lethbridge, Alta., is a Newfoundlander. When a young man, he entered the shops of John McDougall & Co., Montreal, and served six years as a machinist apprentice. He subsequently went to Glasgow, Scotland, and for some time worked in the largest marine engineering shops on the Clyde. He then took to sea life for three and a half years, working as a marine engineer and was awarded a first-class certificate of the British Board of Trade. He returned to Montreal to the firm of McDougall & Co., and was employed as erecting engineer, making a specialty of electrically driven turbine pumps. It was while on this job he was sent to Lethbridge to instal the waterworks pumps, and his services were secured by the city.

Catalogues

W. S. Rockwell Co., New York, have sent us catalogue No. 20, descriptive of the many types of furnace which they manufacture. Illustrations are given of "Rockwell" furnaces built for every kind of service, also a list of industries and operations where furnaces are part of the equipment. Copies of this catalogue may be had on application.

Economy Pumping Machinery, is the title of a new catalogue which has been issued by Thomas & Smith, Chicago. The catalogue deals fully with the "Economy" line of pumps which includes centrifugal, bilge and deep well pumps, sewage ejectors, etc., motor or belt driven. Each type is illustrated and described together with a table giving principal sizes and ratings. In many cases a specification is included. The catalogue also contains some suggestive specifications and several pages of useful information on pumps and hydraulics, which will be helpful when considering pumping propositions.

1913 GRAIN EXPORT FROM MONTREAL.

THE export grain trade from the port of Montreal for the season 1913 has been a record one in the history of the trade and port. The total shipments of all kinds of grain amount to 54,305,172 bushels, as compared with 38,918,264 for the season 1912, showing the handsome increase of 15,286,908 bushels, which to a large extent may be attributed to the remarkable improvements made within the past few years in the facilities of handling grain at the port. The elevator capacity has been increased considerably, and this, coupled with the cheaper all-water rates for grain from Fort William and Port Arthur and the splendid service obtainable from the different Lake lines of steamers, induced exporters to forward all the grain they possibly could by way of Montreal. Notwithstanding these facts, some very large quantities were also exported via United States ports.

Another very important feature in the export grain trade this year which must not be overlooked was the fact that the port was favored with the largest number of tramp vessels ever known owing to the good rates being paid for carrying grain. During the season thirty-seven of this class of vessels arrived, which carried 10,858,555 bushels of grain, divided up as follows:—
Wheat, 5,393,319 bushels; oats, 1,084,774 bushels; barley, 1,937,338 bushels; and flaxseed, 2,443,124 bushels. The largest cargo of grain that ever cleared from the port was carried by the S.S. Kim for Rotterdam, which amounted to over 450,000 bushels, and shipped by the British Empire Grain Co., Ltd. The largest portion of the business was done in wheat, which amounted to 33,252,893 bushels, showing an increase of 2,281,836 bushels, as compared with 1912, while flaxseed came next with a total of 8,253,544 bushels, an increase of 8,214,410 bushels; oats third with an increase of 731,653 bushels; and barley fourth with an increase of 3,966,550 bushels. There were only a few small lots of corn shipped owing to the fact that prices in the United States advanced to such high level on the smaller yield of the crop of 1913 that exporters could not compete with other exporting countries of corn.

The shipments of grain to Bristol or Avonmouth were the largest of any other port, and show an increase over last year of 5,778,989 bushels, while Hull comes second with an increase of 4,504,956 bushels, and Rotterdam third with an increase of 2,352,752 bushels; but, strange to say, the only port with any decrease of importance was Liverpool with 1,003,048 bushels.

With reference to the shippers, Wight & Esdaile have the credit of heading the list again this year, with a total of over 21,750,000 bushels, showing an increase of over 8,111,000 bushels as compared with 1912, while Thomson & Earle have second place with a total of over 14,134,000 bushels, an increase of over 4,932,000 bushels. The British Empire Grain Co., Ltd., are third with a total of over

4,548,000 bushels, an increase of over 1,330,000 bushels, and Jas. Carruthers & Co. come fourth with a total of over 4,360,000 bushels, an increase of over 1,253,000 bushels.

GALT, ONT.

THE town of Galt, Ont., has this year added to its importance as a manufacturing centre. In recent years some of the older established concerns have extended their plants, but this year has seen new factories built. Perhaps from an engineering standpoint the most important is the new plant which the B. F. Sturtevant Co., of Canada, Ltd., have established and which is referred to in another issue of our journal. The Roelofson Elevator Co. also referred to is a year or two older. Other comparatively new concerns are the Galt Shoe Co., and the Galt Brass Co., making plumbers' supplies. The Victoria wheel works have built a new plant for making wooden wheels of all kinds. The Narrow Fabric Weaving & Dyeing Co. make labels and tags for dry goods, boots, etc., while under construction is the factory for the Galt Knife Works where steel machine knives and cutters will be made.

The C.P.R. have built a large freight shed and the Lake Erie & Northern Ry. will enter the town sometime in the spring. As a further inducement to manufacturers to locate in Galt, the Hydro-Electric power rate has been reduced from $23 to $21.50 per horse power per year. At the municipal pumping station, two motor driven turbine pumps have been installed to take care of the increased demand, the population being estimated at 12,000.

The Plant of the Canadian Sirocco Co., Ltd., Windsor, Ont.

Staff Article

Like the new factory of the H. Mueller Mfg. Co., a description of which appeared in our January 1, 1914 issue, the plant of the Canadian Sirocco Co. at Windsor, Ont., is also an instance of American enterprise in the industrial sphere of our Dominion, and gives additional proof of the confidence which manufacturers across the line have in the Canadian market.

RATHER more than two years ago the American Blower Co., Detroit, decided to manufacture their product in Canada, and for this purpose a Company was incorporated under the name of the Canadian Sirocco Co., Ltd. A site covering four acres was purchased at Windsor, Ont., in the factory district adjoining the Essex Terminal Railway. A building was erected and equipped and manufacturing commenced in 1911. The plant as it exists at present was built as the nucleus of a larger plant, and consists of one building, 308 x 50 ft. A siding from the railway runs along the east side of the building, and provides excellent facilities for the shipment of the product, which consists of "Sirocco" fans, heaters and "Detroit" steam traps. The building is of brick construction, with steel columns and roof trusses. The windows are fitted with "Kahn" steel sash and ribbed glass. With the exception of a part at the south end, where are the office and stores, the whole structure is devoted entirely to the manufacture of the product.

The handling of the materials and product is well taken care of by the system of overhead cranes installed. At each end are two hand operated travelling cranes running across the shop, each crane being equipped with a triplex block. Connecting these two sets of cranes and running lengthways is an overhead monorail system, also equipped with a 3-ton triplex block. This arrangement allows for the working of the materials through the various operations towards the centre of the shop for assembling. At the north end the heating coils and traps are manufactured, while at the south end the plate and structural work for the fans is done. The assembling floor is connected to the shipping platform by a gantry, on which operates an overhead hand travelling crane equipped with a 5-ton triplex block supplied by the Rounds Co., Cleveland, O.

Machine Shop.

In that section of the shop devoted to the manufacture of fans there are a number of machine tools, the principal being a Brown, Boggs & Co., Hamilton, double crank press, a Long & Allstatter 84 in. gate shear, a punch by the Cleveland Punch and Shear Co., also circle shears with a capacity up to 3/8 in. steel plate. This machine will cut plates to any shape, and is used principally in the manufacture of fan housings and similar work. A Canton Foundry Co.'s handy crane is used for carrying materials about the shop.

The other half of the shop is devoted to the manufacture of heater coils and "Detroit" steam traps. The pipes are carried from outside through an opening in the wall at the end to a machine, where they are measured and cut off to the desired lengths. The pipe lengths are then threaded in a double head threading machine fitted with "Landis" die heads and supplied by the Canada Machinery Corporation. The elbows are put on in a special machine designed by the Company for that work. The cast iron heater bases are reamed and tapped on a machine supplied by the Murchey Machine Tool Co., Detroit. The table or carriage for this machine is mounted on roller bearings, which allow for the movement of the work during the operations, with the least possible effort on the part of the operator. The heater bases are previously drilled on a Pawling & Harnischfeger horizontal boring and drilling machine, which is motor driven with speed control. This machine is also fitted with a balanced drill head for accommodating various sizes of work. There are also installed through-

INTERIOR OF FAN AND HEATER ELECTRIC SHOP

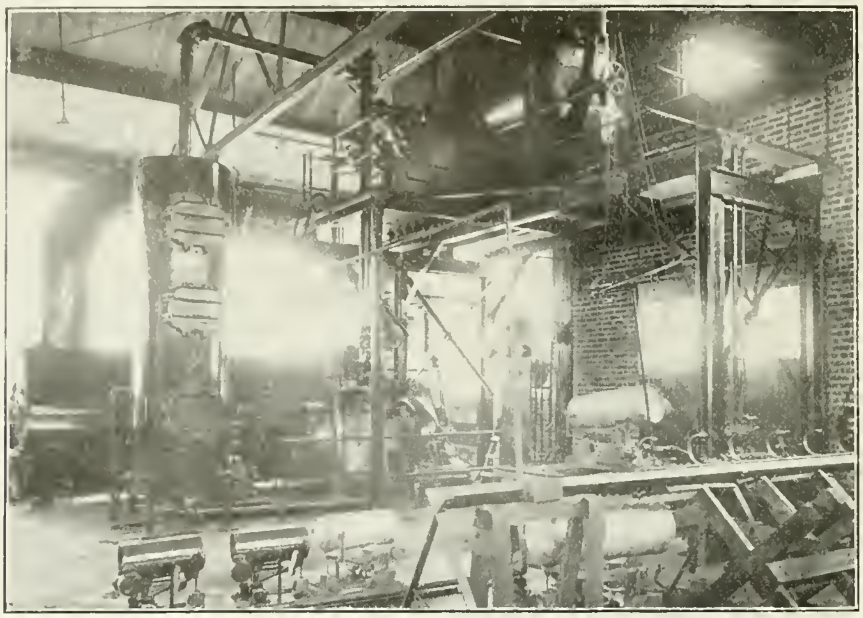
out the shop a number of standard tools of various types. The machines are arranged in four groups, and the line shafts in the various sections are driven by four Canadian Westinghouse motors—two 20 h.p., one 15 h.p., and one 10 h.p.

Power Plant.

The power plant is located in the north-west section of the building, and consists of a 90 h.p. "Monarch" horizontal tubular boiler, supplied by the International Engineering Works, Ltd., Amherst, N.S. The boiler is fired by natural gas, and supplies steam to an American Blower Co. vertical high speed engine. The latter is fitted with combination forced and gravity lubrication. There are 2 h.p. cylinders, 7 in. diameter by 7 in. stroke, and direct connection is made to a 40 k.w. D. C. Fort Wayne Electric Co. 3-wire generator running at 450 r.p.m., and supplying current at 220 volts for the motor and 110 volts for the lighting circuits respectively.

The switchboard is equipped with the usual instruments, lighting and power switches, and was supplied by the Fort Wayne Electric Co., Fort Wayne, Ind. The feed water is heated in a 100 h.p. "Dakin" feed water heater supplied by E. Leonard & Sons, London, and has in connection with it two "Detroit" return traps, which take care of the boiler feed; one trap being located on the ground floor and the other below the platform, where the heating system is installed.

On a platform above the power plant is a "Sirocco" heating and ventilating system. The coils in the heater are supplied with exhaust steam and a "Sirocco" fan draws air through the heater and discharges same into the building, the air in the shop being changed every 15 minutes. The fan is driven by an A.B.C. steam engine direct connected. The condensation from the heating coils is taken care of by the return traps. Compressed air is supplied at 80 pounds pressure by an A.B.C. steam engine converted into an air compressor.



POWER AND HEATING PLANT.

General.

The Company is associated with the American Blower Co., Detroit, and is under the management of Mr. Ralph T. Coe. A complete line of fans, heaters and traps are being manufactured at this plant, the engines only being imported from Detroit. It is the intention at some future date to extend the plant when the complete line as made at Detroit will be manufactured at Windsor.

FISHER MOTOR CO., LTD.

ONE of the many enterprising firms in Walkerville, Ont., is the Fisher Motor Co., Ltd. This concern have a well equipped plant for the manufacture of the Vollan's electric butt and spot welders, which are built to meet all requirements and for either a.c. or d.c. current. Additional machinery has recently been installed, and it is probable that extensive additions to the plant will be made early next year to take care of the increasing volume of business.

D. H. McDougal, manager of the Dominion Coal Co., Sydney, N.S., was a visitor in Montreal during last week.

PLANT EXTERIOR, CANADIAN SIROCCO CO., LTD.

Determining the Cutting Power of Lathe Turning Tools*

By William Ripper, D. Eng. D.Sc. and G. W. Burley **

The question of the definite measure of the output of work, or of the removal of material, of which lathe-tools are capable, is one about which there is very little information readily available; and it was for the purpose of determining the behavior of cutting tools over a fairly wide series of working conditions, and of deducing therefrom some practical results, that the experiments here detailed were undertaken.

THE tool steel lathe was built by Joshua Buckton & Co., of Leeds, and is of such a design that it can be employed for testing either high-speed lathe-tools or large twist-drills, the latter being made possible by a special arrangement provided in the loose headstock. It is an 18-inch centre lathe, the bed, however, being of the size usually provided on 20-inch lathes, thus giving extra stiffness.

The overall length of the lathe, including the bed-plate of the main driving motor, is about 25 feet. The dimensions of the largest test-bar which can be carried between the centres are: length 10 feet, and diameter 25 inches. The test-bar is held by four independent dogs or jaws mounted on a large driving plate, which is carried by the main driving spindle. At the loose headstock end, the bar is supported by an ordinary centre of ample proportions.

Fig. 46

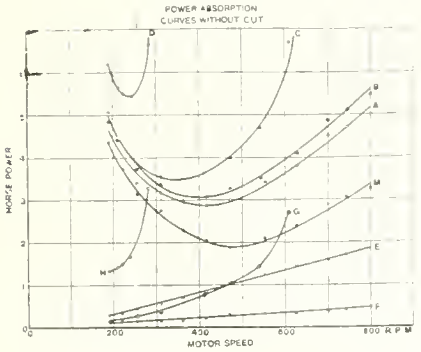


Fig. 48.

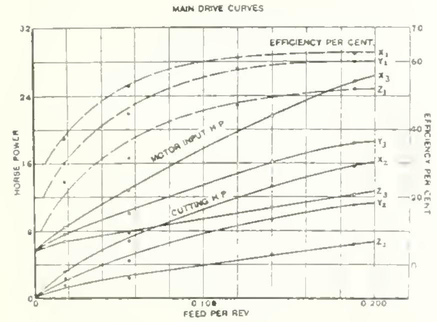
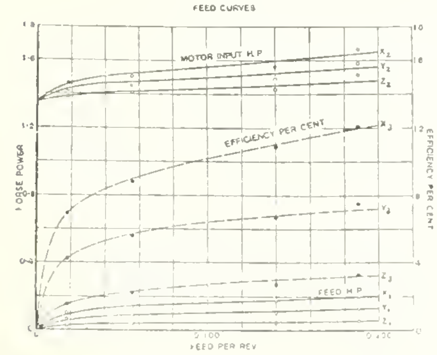


Fig. 49



Lathe Drive.

The lathe is driven by a 40-b.h.p. direct-current motor. This motor can actuate the driving plate on the main spindle in the headstock in two different ways:

(1)—Directly, by coupling the armature of the motor to the main spindle.

(2)—Indirectly, through gearing.

The direct connection is obtained by means of a tongue on the headstock end of the motor armature shaft, and a corresponding slot in the motor end of the main spindle of the headstock. This mode of driving is only used when very high rotary speeds are required, as in the case of drill tests. The indirect connection is obtained by means of a pinion on the headstock end of the motor armature shaft, which engages with another pinion mounted on a gear shaft passing through the headstock.

In the headstock, any one of three sets of gears can be used for transmitting the power and motion to the driving plate. This plate is driven by a toothed pinion, which works in gear with the teeth on the back portion of the rim of the driving plate, and which is an integral part of the plate. The power is thus transmitted directly to the rim of the driving plate and not through the main spindle. The gears are so arranged that only one set can be in action at the same time, and they are controlled by means of levers on the front of the headstock. The gears are:—

(1)—Single gear, giving driving plate or spindle speeds from 50.5 to 202 revolutions per minute, according to the speed of the motor.

(2)—Double gear quick, giving driving plate speeds from 16 to 64 revolutions per minute.

(3)—Double gear slow, giving driving-plate speeds from 5 to 20 revolutions per minute. The gear ratios, including ratio between the driving pinion and driving-plate gear in each case, are as follows:

Single gear ....1 : 3.96
Double gear quick....1 : 12.50
Double gear slow....1 : 40.00

The Slide Rest.

The slide rest is of the ordinary compound type, having a top swivelling slide, with tool clamps, and a cross or surfacing slide. A large feed apron is provided on the slide rest for carrying gears for power sliding and surfacing. The slide rest is rack driven, the power being supplied to it by a feed shaft on the front of the lathe bed. This feed shaft can be actuated either directly from the main driving spindle in the headstock or by a separate feed motor.

Altogether eight different feeds, travel of the slide-rest per revolution of the test bar, can be obtained for sliding, surfacing and drilling with the direct drive as follows:—

CLUTCH LEVER.	COARSE.				FINE.			
Sliding-key Lever.	1	2	3	1	1	2	3	1
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
Sliding	1-4	1-6	1-8	1-12	1-20	1-30	1-40	1-60
Surfacing	1-8	1-12	1-16	1-24	1-40	1-60	1-80	1-120
Drilling	1-20	1-30	1-40	1-60	1-100	1-150	1-200	1-300

The feed-shaft drive from the independent feed motor is through a motor feed-gear box containing spur gear and clutches, so that fast and slow feeds are provided for. Feeds varying from 0.090 inch per minute to 200 inches per minute can be obtained when using the motor drive for the feed. A graduated dial is mounted on the cross-slide screw, the divisions on the dial being 1-64 of an inch, so that depths of cut varying by 1-64 of an inch can be attained with great accuracy. The zero of the dial is adjustable.

The Headstock.

The loose headstock is of massive proportions, the mandrel or spindle of this being so arranged that it can be fed along either by hand, when making slight adjustments, or by power for drill testing. On the tail end of the screw of the headstock is mounted a worm wheel, with which a worm can be put into mesh. This worm receives its motion from the feed shaft through spur and bevel gearing, and transmits to the screw through the worm wheel.

*Part III. of a paper read recently before the Institution of Mechanical Engineers.
**Dean of the Faculty of Applied Science and of the Staff, respectively, of Sheffield University.

An auxiliary rack is provided on the bed for the special purpose of moving the headstock along the bed whenever required.

(1) M[illegible]

Depth of Cut	Feed per Rev	Motor Input	H.P. at Tool	Overall Efficiency	Motor Efficiency	Lathe Cutting Efficiency
inch	inch	H.P.		Per cent	Per cent.	Per cent.
⅛	0·0185	5·81	1·5	25	56	45
	0·0651	7·70	2·4	31	58	53
..	0·1417	10·84	5·2	47	69	68
	0·1880	12·33	6·4	52	72	72
¼	0·0185	7·59	2·3	30	58	53
	0·0651	9·96	4·1	41	61	67
..	0·1417	16·20	9·4	58	76	76
	0·1880	18·33	11·0	60	78	77
⅜	0·0185	8·49	3·1	37	60	62
	0·0651	12·78	6·8	53	71	75
..	0·1417	21·80	13·2	61	80	76
	·1880	25·70	15·8	63	81	77

(2) *Feed Drive*

Depth of Cut	Feed per Rev	Motor Input	Feed	Overall Efficiency	Motor Efficiency	Feed Efficiency
inch	inch	H.P	H P	Per cent	Per cent.	Per cent.
⅛	0·0185	1·38	0·02	1·5	45	3·3
..	0·0651	1·40	0·03	2·1	46	4·6
	0·1417	1·45	0·04	2·7	47	5·8
..	0·1880	1·51	0·05	3·3	48	6·9
¼	0·0185	1·42	0·06	4·3	46	9·2
..	0·0651	1·45	0·08	5·6	47	11·7
..	0·1417	1·49	0·10	6·7	48	14·0
..	0·1880	1·58	0·12	7·6	49	15·5
⅜	0·0185	1·46	0·10	6·9	47	14·7
.	0·0651	1·50	0·13	8·7	48	18·2
..	0·1417	1·56	0·17	10·9	49	22·0
..	0·1880	1·66	0·20	12·1	50	24·2

LATHE EFFICIENCY TEST RESULTS.

This is done by means of a handle on the front of the headstock, which is connected to the rack through spur and bevel gears and rack pinion.

The lathe bed is graduated in inches so that the travel of the slide-rest in any given time or for any given number of revolutions of the test bar can be determined. A revolution counter is connected to the main spindle of the driving headstock so that the number of revolutions made by the test bar in any given time can be determined.

Electrical Plant for Operating Experimental Lathe.

The lathe is driven by means of two direct-current motors, one arranged for the main drive and the other for operating the feed mechanism. These motors take their power from a motor-generator set situated in close proximity to the machine, and the whole forms a good example of an isolated plant for motor driving.

Two-phase current at 2,000 volts pressure and 50 frequency is received from the corporation mains and operates a two-phase, 2,000 volt, slip ring induction motor made by the British Westinghouse Co., and capable of giving 76 b.h.p. at a speed of 960 revolutions per minute. Direct coupled to this is a 50-kilowatt compound wound dynamo of the same make, generating at a pressure of 220-250 volts.

Tensile Strength. 27·2 tons per square inch.

Area of Cut.	Associated speed. S.	Cubic inches removed per hour.	Net Power h.p.	Cubic inches per h.p.-hour.	
inch.					
⅛ × ⅛	60	674	5·95	113·3	113·0
.. 1/12	80	599	5·04	118·9	
.. 1/20	112	504	4·49	112·3	
.. 1/30	156	460	4·28	107·5	
3/32 × ⅛	68	572	5·07	112·8	113·2
.. 1/12	88	493	4·62	109·1	
.. 1/20	129	427	3·97	107·5	
.. 1/30	176	393	3·19	123·2	
1/16 × ⅛	78	438	3·71	118·0	121·2
.. 1/12	100	374	3·02	123·9	
.. 1/20	142	319	2·73	116·9	
.. 1/30	196	282	2·24	125·9	

Average cubic inches per h.p.-hour = 115·8.

POWER TESTS, HIGH SPEED STEEL, BAR A.

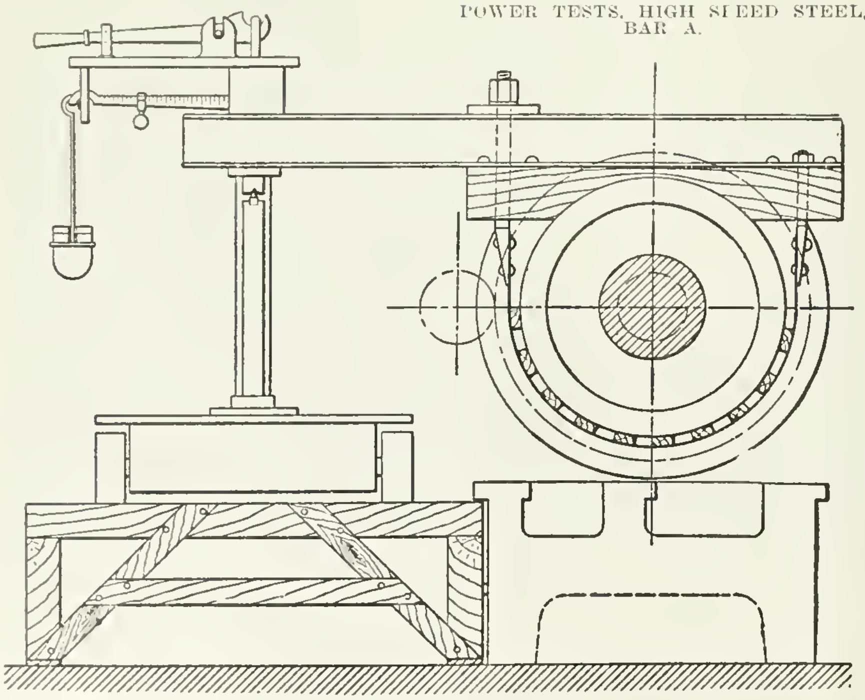


FIG. 47. METHOD OF APPLYING BRAKE TO LATHE.

These machines are controlled by means of a two-panel marble switchboard. The alternating current panel contains a two-phase high tension oil break switch, with automatic overload release; a voltmeter capable of reading either the received or the generated pressure; two ammeters; and a two-phase wattmeter, so that the input to the alternating current motor can be observed. The second panel controls the generator, and is arranged with switches and instruments enabling the input to each of the motors to be observed separately. The chief feature of this panel is that a recording wattmeter is inserted in each motor circuit and a permanent record in the shape of a power-time curve is obtained. The whole of the switchboard and instruments are of Westinghouse manufacture except the voltmeter and the recording wattmeters, which are of Kelvin & White and Elliott Brothers makes respectively.

(a) *Test-Bars for Carbon-Steel Tool Tests.*

Letter of Identification.	Carbon.	Silicon.	Manganese.	Sulphur.	Phosphorus.	—
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
W	0·23	0·027	0·45	0·025	0·025	Mild Steel.
X	0·39	0·075	0·60	0·030	0·038	Medium Steel.
Y	0·64	0·053	0·60	0·032	0·040	Hard Steel.
Z	0·82	0·030	0·36	0·032	0·040	Very Hard Steel.

(b) *Test-Bars for High-Speed Steel Tool Tests.*

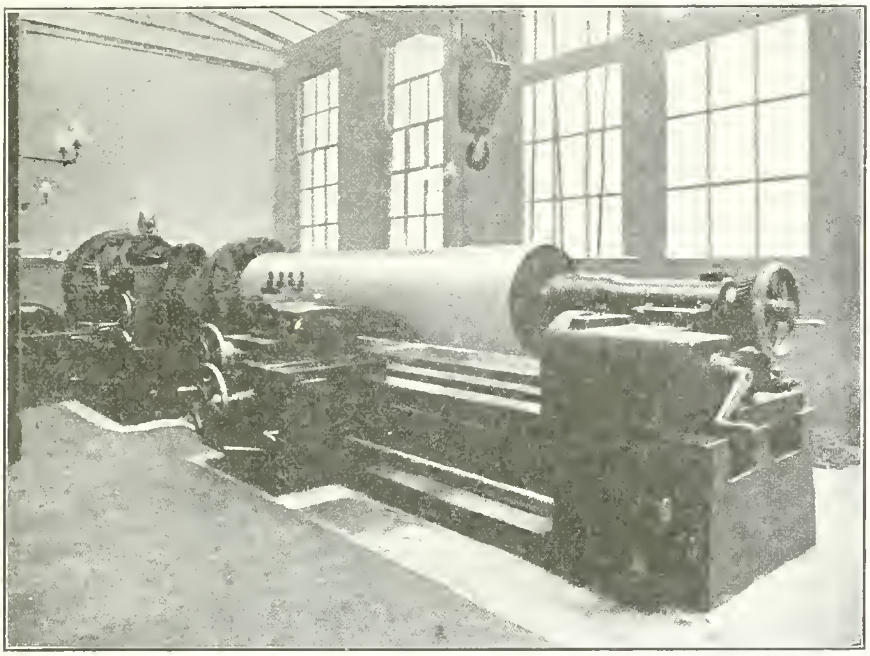
Letter of Identification.	Carbon.	Silicon.	Manganese.	Sulphur.	Phosphorus.	—
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
A	0·29	0·100	0·42	0·037	0·028	Mild Steel.
B	0·39	0·075	0·60	0·030	0·038	Medium Steel.
C	0·60	0·249	0·63	0·053	0·030	Hard Steel.

CHEMICAL COMPOSITION OF TEST BARS.

The main driving motor on the lathe is of 40-b.h.p. capacity, made by Vickers. It is a 4-pole, 220-volt shunt-wound machine with interpoles, and is capable of running at speeds varying from 200 to 800 revolutions per minute, the speed variation being obtained solely by means of a rheostat inserted in the field magnet circuit of the motor. The feed motor is a 4-pole shunt-wound 220-volt 5-b.h.p. motor, also of Vickers' make, and is capable of having its speed varied from 275-1,100 revolutions per minute by shunt regulation as in the former case. An electro-magnetic speed indicator is connected by a flexible shaft to each motor.

From the generator panel cables are led to two smaller switchboards containing the necessary gear for starting and operating the driving and feed motor respectively. These boards contain an ordinary type of direct current motor

starter with no-load and over-load release magnets, two main fuses, and a 23-step rheostat for speed variation; there is also a supplementary rheostat for the driving motor, so that speeds intermedi-


TOOL STEEL TESTING LATHE. ENGINEERING DEPARTMENT, UNIVERSITY OF SHEFFIELD.

ate with those given by the former may be obtained. This supplementary rheostat, having eleven contacts, is connected in series with the main rheostat, the two being so arranged that any one of the contacts of the first rheostat can be used in conjunction with any one of the second. Thus, 253 different motor speeds can be obtained for one voltage, these ranging from 200 to 800 revolutions per minute.

With the four different methods of driving the face plate of the headstock, with and without gearing, upwards of 1,000 different surface speeds are available for one diameter of test-bar. The rheostat of the feed motor provides for twenty-three different motor speeds, and these with all the possible changes in the feed-gear boxes give upwards of 700 different feeds—travel per minute, for one voltage.

Measurements of Lathe Efficiency.

Experiments were made on this lathe to determine the various losses which occur in the driving motor, headstock gearing, etc., when the lathe runs without cut under the various possible conditions of speed, etc., and also the motor input, useful power, and efficiency when cutting at a given speed for both the driving and the feeding parts of the lathe.

The relation between the various power losses and the motor speed is in-

Tensile Strength 33·6 tons per square inch.

Area of Cut	Associated speed. S.	Cubic inches per hour.	Net Power h.p.	Cubic inches per h.p.-hour.	
inch.					
$\frac{1}{8} \times \frac{1}{12}$	67	501	4·40	113 9	112 6
" $\frac{1}{20}$	92	413	3·73	110 8	
" $\frac{1}{30}$	130	390	3·45	113·1	
$\frac{3}{32} \times \frac{1}{12}$	74	416	3 70	112 4	112·4
" $\frac{1}{20}$	106	357	3 25	109 8	
" $\frac{1}{30}$	144	324	2 82	114·9	
$\frac{1}{16} \times \frac{1}{8}$	62	349	3 20	109 1	112·8
" $\frac{1}{12}$	83	311	2·85	109·1	
" $\frac{1}{20}$	118	266	2 35	113 2	
" $\frac{1}{30}$	164	245	2 04	120 0	

Average cubic inches per h.p.-hour = 112 6.

POWER TESTS, BAR B.

dicated in Fig. 46. Curve M, represents the case of the motor running light, the horse-power being the motor input—electrically, this being obtained by readings from the switchboard instruments. The fall in the power required with an increasing rate of revolution between 200 and 500 revolutions per minute is due mainly to the reduction in the magnetization current—to produce the weakened magnetic field, being greater than the increase in the armature current required to cover the increase in the armature current required to cover the increase in the mechanical frictional losses in the bearings, etc., due to the

(a) Test-Bars for Carbon-Steel Tool Tests

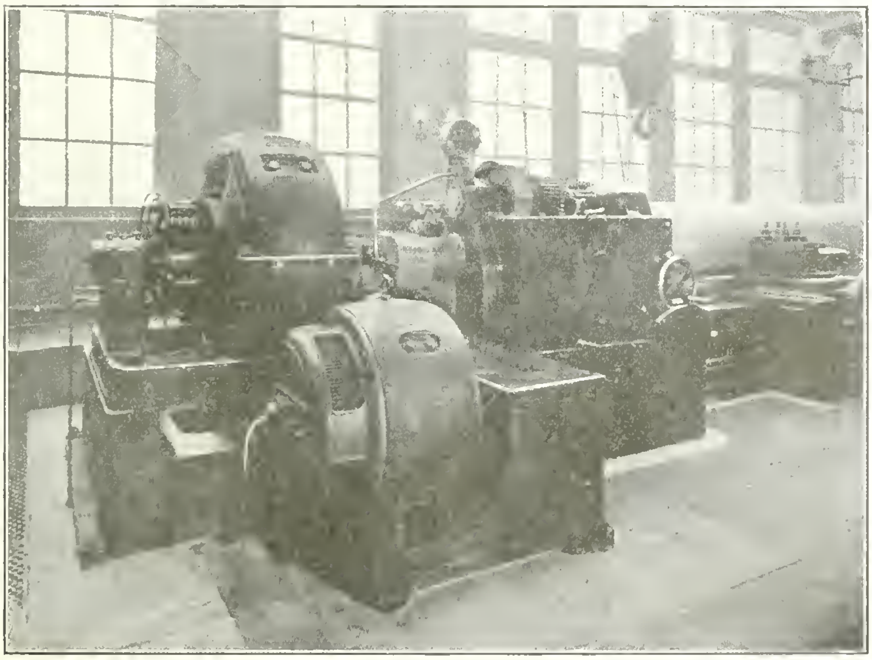
Letter of Identification	Breaking Load in tons per sq. inch.	Elongation per cent.	Compressive Load in tons per sq. inch.
W	24 8	28 8	74 8
X	33 5	21 7	90 0
Y	40 5	23 3	106 8
Z	51 2	9 3	128 0

(b) Test Bars for High-Speed Steel Tool Tests

Letter of Identification	Breaking Load in tons per sq. inch	Elongation per cent	Compressive Load in tons per sq. inch
A	27 2	28 4	91 2
B	33 5	21 7	90 0
C	50 5	12 0	126·4

PHYSICAL PROPERTIES OF TEST BARS.

speed increase. Beyond 500 revolutions per minute, the latter is much greater than the former; hence the rise in the curve for this speed range.


ELECTRICAL PLANT FOR OPERATING EXPERIMENTAL LATHE

Curve A is the corresponding curve for the motor and headstock gearing without the driving spindle and face-plate. It was found that the power lost was practically the same for each of the three sets of headstock gearing, provided that the driving spindle and face-plate were not in motion. Curve E, which represents the difference between M and A, gives the net power lost in the gearing only at the different motor speeds.

Curves B, C, and D are the corresponding curves for the motor, headstock gearing, driving spindle, and test-bar without cut. These curves represent the three sets of gearing as follows:—

Curve B: Double Gear Slow . . 1 : 40

Curve C: Double Gear Quick 1 : 12.5

Curve D: Single Gear . . . . 1 : 3.96

Curves F, G, and H represent the net losses due to the motion of the test-bar and driving-plate.

To determine the horse-power developed at the nose of the tool under a cut, brake-load tests were made on the lathe with different loads, at different motor speeds, and with the different sets of headstock gearing in action. The conditions of these tests were arranged so that, as nearly as possible, they corresponded to actual cutting conditions.

The form of brake used is shown in Fig. 47. The brake-drum was mounted directly on a test-bar which run in the ordinary way, being driven from the face-plate by dog-chucks. The length of the arm of the brake was 45 inches, and the pillar carrying the knife edge rested on the platform of a 20-cwt. weighing machine. The brake horse-power was calculated by means of the formula:

$$\text{B.H.P.} = \frac{2p \times 45}{12 \times 33{,}000} \times PN = \frac{PN}{1{,}400}$$

Tensile Strength 30 5 tons per square inch

Area of Cut	Associated speed S	Cubic inches per hour.	Net Power h.p.	Cubic inches per h.p.-hour	
inch					
1/8 × 1/12	29	217	2·67	81 3	80·7
„ 1/20	43	192	2·38	80 7	
„ 1/30	56	165	2·06	80·1	
3/16 × 1/24	35	196	2·43	80·7	80·1
„ 1/40	49	162	2·03	79·8	
1/60	64	143	1·79	79·9	
1/16 × 1/8	33	185	2·28	81·2	81 0
„ 1/12	39	146	1 83	79·8	
„ 1/20	55	122	1·48	82·4	
„ 1/32	75	108	1·34	80·6	

Average cubic inches per h.p. hour = 80·6

POWER TESTS. BAR C.

P and N being the load in lbs. and the revolutions per minute of the test-bar respectively.

From the data of these tests, an input curve was drawn from which the output or b.h.p. for any input could be obtained. This curve was used in connection with the actual cutting tests to determine the h.p. developed at the nose of the tool corresponding to each input as obtained from the switchboard instruments.

In the cutting tests, in which the cutting speed was 50 feet per minute, the feed was obtained independently from the feed motor, four different average feeds being adopted, as follows:—0.0185 inch, 0.0551 inch, 0.1417 inch, and 0.1880 inch per revolution of the bar. These are the actual feeds, their values having been obtained by means of actual measurement and calculation. The depths of cut were three in number, as follows:—1/8 inch, 1/4 inch, and 3/8 inch.

The net feeding power in each case was obtained by taking the difference between the motor input, with the cut in, and with the tool withdrawn, respectively, the slide rest being in motion in each instance. This difference may not be exactly the power required to propel the slide rest against the resistance due to the cut only, but it is sufficiently close for all practical purposes.

The curves in Fig. 48 give the relation between the gross main-driving motor input X_1, the net cutting power X_2, and the overall main-drive efficiency X^1.

The curves in Fig. 49 give the corresponding relation between the gross feed-motor input, the net feeding power, and the overall efficiency.

The curves X are for the 3/8 inch depth, Y for the 1/4 inch depth and Z for the 1/8 inch depth.

In the case of the main-drive curves

$$X_1 = \frac{X_2}{X},$$ while for the feed curves

$$X_1 = \frac{X_1}{X_2}$$

Date of Test . . . . No. of Test . . . .

No. of Tool . . . . Size of Tool . . . .

Shape of Tool Nose . . . . . .

Angles of Tool Nose:—

Clearance: Front ; Side . . . . .

Top Rake: „ ; „ . . . . .

No. of Test Bar . . . . . . Diameter of Test Bar . . . .

Time of Start }
„ „ Finish } Duration of Test

Revolution Counter at Start . . . . . . }
„ „ „ Finish . . . . } Total Revs. . . . .

Surface Speed, in Feet per Minute

Depth of Cut Feed per Revolution

Volts: Light }
Load } Net Power . . k.w.
Amps: Light } „ „ h.p.
Load . . . . . . }

Headstock Gearing

Motor Rheostat Contacts

LATHE TOOL TEST SHEET.

Moncton, N.B.— Among the plants erected here during the past year, one of the largest was that of the Humphreys Unshrinkable-Underwear, Ltd., the foundations for which were laid in November, 1912, the plant being completed and in operation by the following April. It is built of brick and concrete, and contains 4,000 feet of floor space. Power is generated by gas engines using natural gas. About eighty persons are employed. Among other new plants in this town is that of the Havelock Mineral Spring Co., Ltd., makers of aerated waters, who moved their plant from Havelock, N.B., to Moncton, and equipped it with modern machinery.

Walter Hazlett, of Kingston, Ont., for some time chief engineer on the steamer Kingston, has been appointed assistant to Captain Gilbert Johnston, mechanical superintendent of the passenger steamers of the Canadian Steamship Lines, Ltd., with headquarters at Montreal. He will be succeeded by David Leslie, of the steamer Rapids King.

Steam and Hydro-Electric Power Plants at Kamloops, B.C.

By W. Large

The accompanying text and illustrations serve to show that Western municipalities are fully alive to the requirements of industries seeking location, in the matter of power, light and water for manufacturing purposes, and that, they, in addition, recognize the all-important consideration, of providing an equipment, both tried and up-to-date.

KAMLOOPS opened its new power house on October 28, with everything in excellent shape. The Royal Commission on Indian Affairs who were in the city paying a visit of inspection, were present in addition to many prominent citizens.

It was found last year that Kamloops could not do any longer with its old power house, which had become too small to carry on the increasing demands for water and light, and arrangements were made to erect an entirely new building with all modern machinery. It had also been planned some time ago to bring power from the Barriere River, 40 miles up the North Thompson, where 10,000 horse power was available, if harnessed, and arrangements have been made to use 2,000 horse power to commence with, and to increase the amount as the city's demands may call for later. Bonds to the amount of $460,000 were therefore issued, $200,000 of which was needed for the power house just completed, and $260,000 for the Barriere Rivere development. At present, some 2,400 horse power is generated at the new station.

The main building is of reinforced concrete and thoroughly fireproof throughout. It consists of two bays; one containing the boilers being 40 ft. x 75 ft., and the other, containing the turbines, pumps and other machinery being 50 ft. x 75. ft. The basement of the turbine bay is on the same level as the boiler room floor and contains the auxiliary apparatus, condensers, transformers and air pumps, besides providing storage for operating supplies. The stack is of concrete, and is 78 inches diameter at the bottom, by 175 feet high above ground level.. The equipment of the station is as follows:—

Four Babcock & Wilcox boilers of 250 h.p. each and working at 160 lbs. pressure.

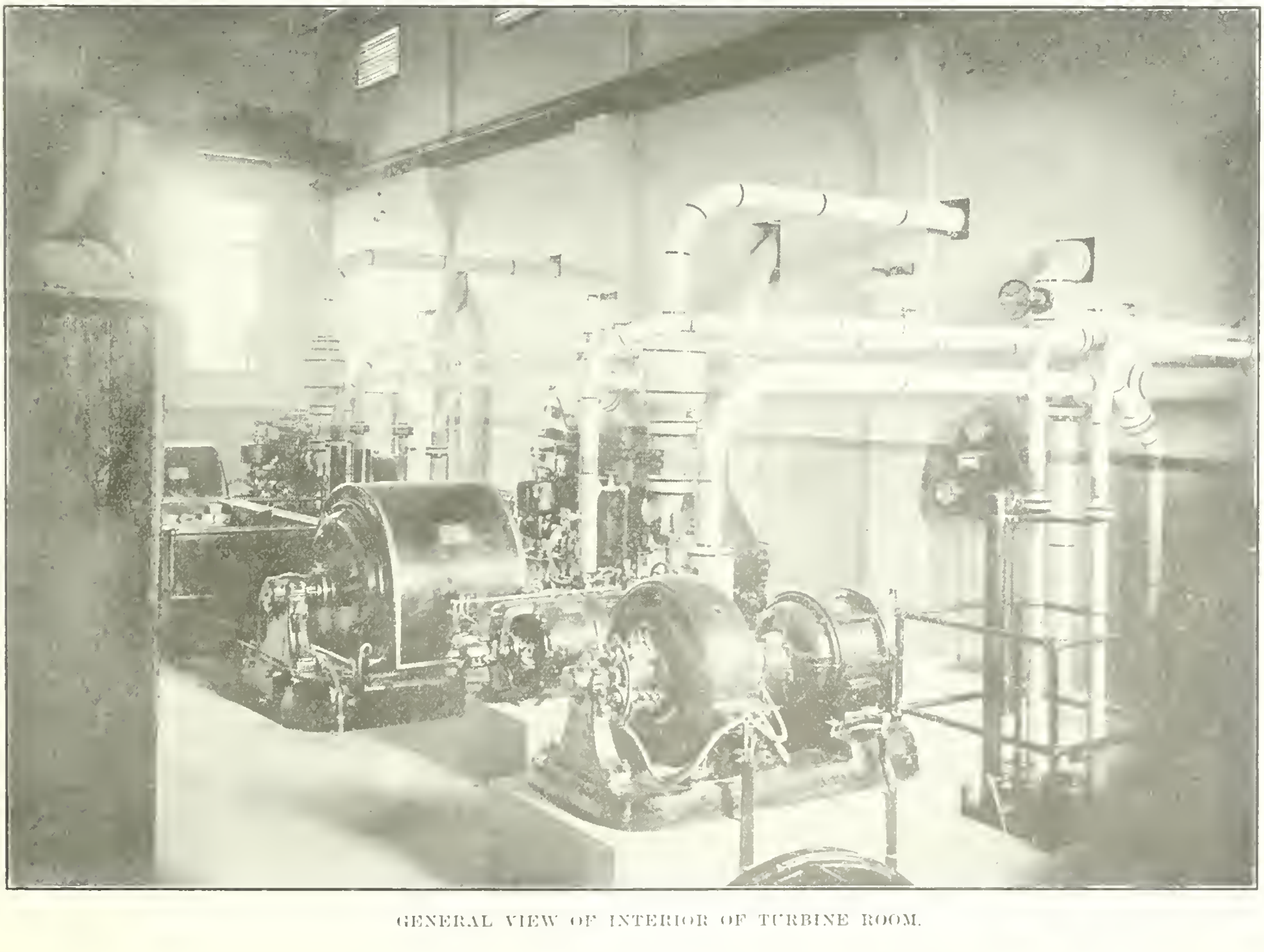
Two boiler feed pumps by the Platt Ironworks, Dayton, Ohio, and a Ford heater.

Two Curtis turbo-alternators of 600 k.w. capacity, 2,200 volts, three-phase, 60 cycles, operating at 3,600 revolutions per minute. These were supplied by the Canadian General Electric Co., and have forced lubricated, water cooled bearings, electric speed changing device and an over speed safety trip. The turbines exhaust into two Wheeler cylindrical surface condensers, which are equipped with turbine driven circulating pumps. The condensers indicate continuously from 27 to 28 inches of vacuum.

One 15 k.w. turbine driven exciter running at 4,500 revolutions per minute.

One 20 k.w. motor driven exciter running at 1,200 revolutions per minute.

The switchboard is of natural slate and consists of 21 panels for the different services. All high voltage wiring, oil switches and other apparatus, which



GENERAL VIEW OF INTERIOR OF TURBINE ROOM.

would prove dangerous to the operators, are located on a structure some distance to the rear of the switchboard. There is nothing on the switchboard at a potential above 110 volts. An approved type of voltage regulator maintains constant voltage regardless of load variation.

No outgoing power or light lines can be seen at the station, as the conduits run underground through a tunnel under the main line of the C.P.R. to a distributing tower immediately across the track. Beneath the distributing tower is a small substation containing the transformers for a 12,000 volt line to the Iron Mask mine, about eight miles from the city.

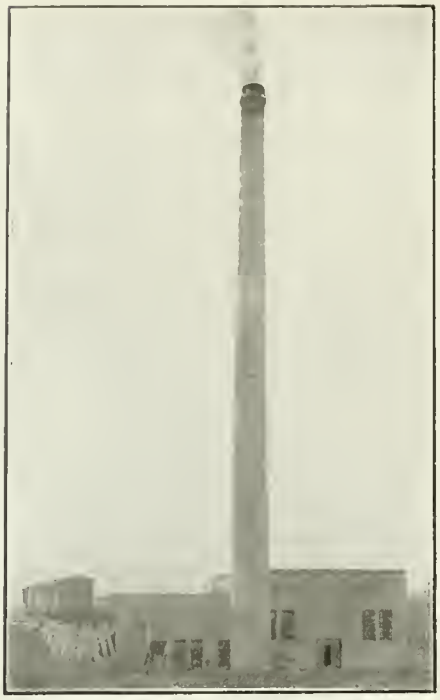
Water Works Section.

The waterworks section of the plant consists of the following:—

Two induction motor driven Platt pumps working at 1,800 revolutions per minute, and delivering 1,200 gallons per minute.

One Kerr turbine driven pump of the same capacity, the turbine exhausting into a Wheeler waterworks type condenser with Edwards air pump. These three pumps discharge through a Simplex Venturi meter with indicating curve drawing and integrating apparatus to register the water pumped into the city mains.

Directly underneath the pumps is a



EXTERIOR OF POWER HOUSE.

16,000 gallon suction tank, which is kept supplied by two vertical motor driven pumps, located in an auxiliary pump house on the bank of the South Thompson river. Both pumps in the auxiliary pump house are operated from the switchboard, one by a standard hand operated starter and the other by an automatic starter controlled by a float switch. These pumps discharge 1,500 gallons per minute through a 16-inch steel main into the suction tank. From the power house, the main pumps deliver through a 16-inch steel main to a 1,500,000 gallon reservoir, built last year.

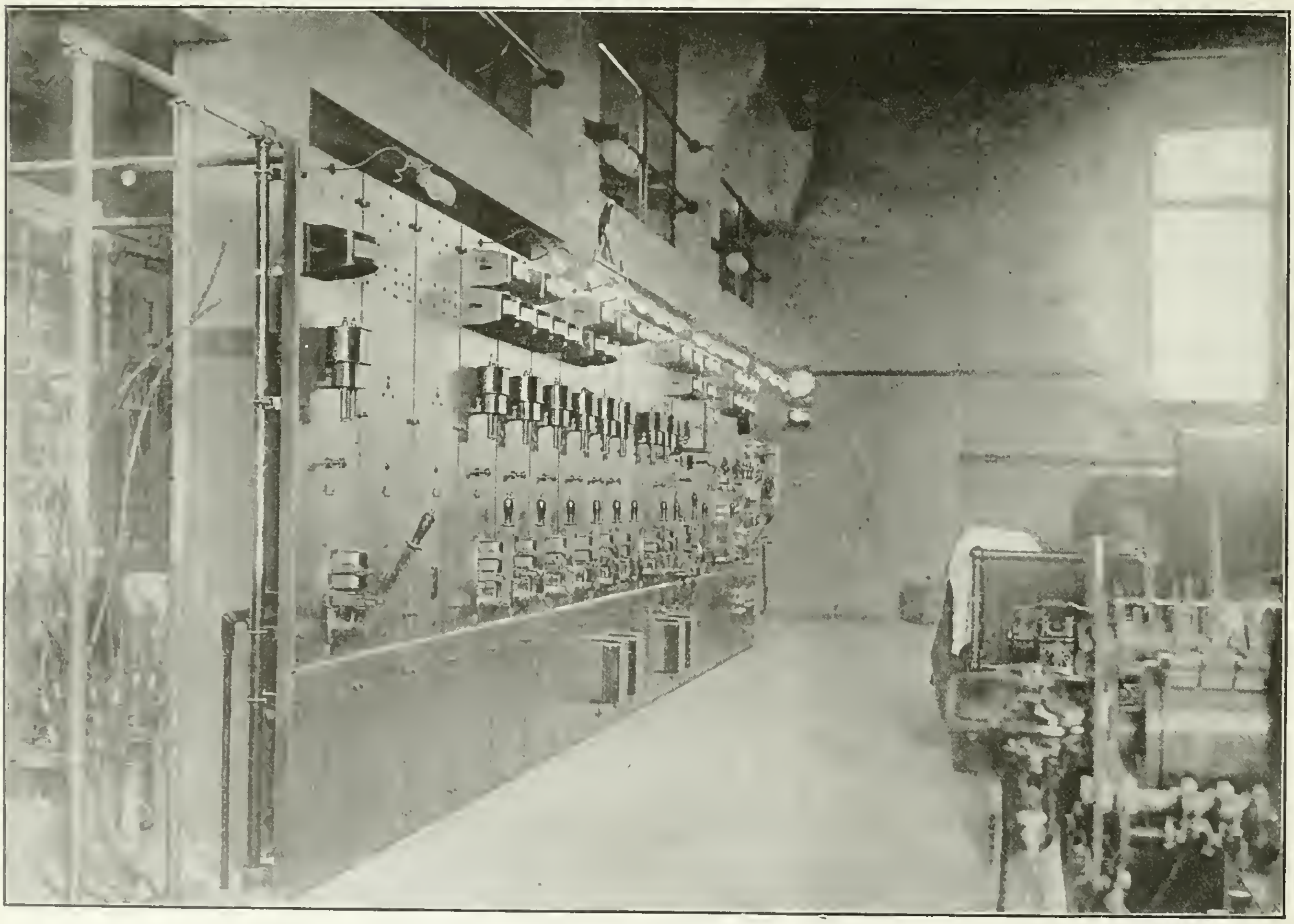
The turbine bay and pump room are served by a 10-ton hand operated travelling crane.

Ashes from the boiler room are handled by a motor driven endless chain conveyer from a hopper on the boiler room level to a distance of 40 feet from the boiler room.

Coal is dumped from an overhead spur into bunkers, from which it gravitates into the boiler room through chutes in the rear wall.

The Barriere Plant.

In connection with the equipment of the Barriere plant, the local station will

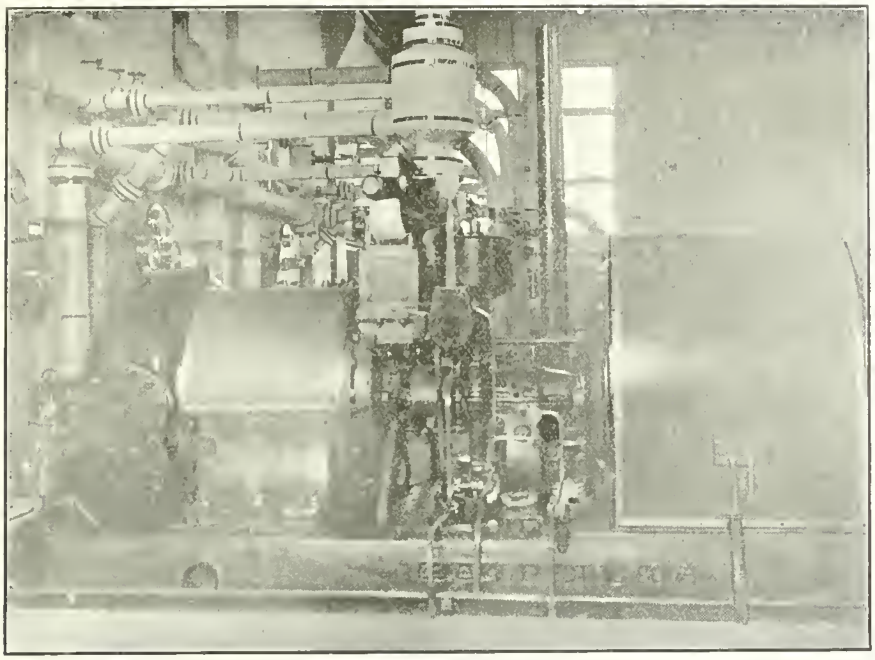


VIEW OF NINETEEN PANEL SWITCHBOARD.

be utilized with the exception of the turbines and boilers, the turbines being arranged to run in parallel with or to replace the hydro-electric machines in the event of interruption .

The Chas. C. Moore Co., had the contract for supply and installing the equipment, while the building was erected by the local firm of Johnston & Co. The stack was erected by the Weber Chimney Co., of Chicago.

The entire design and construction was carried on under the supervision of Ducane, Dutcher & Co., consulting engineers.



600 K. W. CURTIS TURBO-GENERATOR

CAPTAIN FOOTE NAMED TO INVESTIGATE WRECKS.

THE announcement was made a few days ago that Captain James B. Foote, one of the best-known marine experts of our Great Lakes, and manager of the marine department of the Toronto Insurance and Vessel Agency, with headquarters in Toronto, had been recommended by the Dominion Marine Association as their representative on the Commission to be appointed by the Dominion Government for the purpose of investigating marine wrecks and disasters on the Great Lakes.

Captain Foote was the unanimous choice of the members. The captain, who, until a few years ago, was actively engaged in sailing operations, has had a varied and interesting career in all departments of Great Lakes transportation, and his knowledge of shipping, the construction of vessels and other features relative to the qualifications of a marine expert, guarantees his capabilities for the position.

He comes from a family of lake captains, and the representatives of the Dominion Marine Association has every reason to believe that he will receive the endorsation as a member of the Commission by Hon. J. D. Hazen, Minister of Marine and Fisheries. The suggestion for a representative on the Commission emanated from the Dominion Marine Association as a result of the recent disasters on Lake Huron.

FERRY WAR OVER.

THE war between the town of Sarnia and the Port Huron & Sarnia Ferry line is over. The Loughead estate has relinquished the lease of the town dock. Ever since the ferry line placed itself outside the jurisdiction of the town by-law by operating as a passenger and freight line, the town dock has been the bone of contention between the Company and the Town. The aldermen were unable to make the ferry Company pay rent. The ferry line leases from the Loughead estate, and the dock of the estate adjoins the town dock.

To try and settle all trouble, the Town Council some four weeks ago leased the town dock to the Loughead estate at $100 per annum for a period of ten years. Ex-Mayor John McGibbon, who started the ferry war in his tenure of office, stated in a curt, concise letter to the council that it has exceeded its authority in putting through the said lease by not publishing notice thereof in the papers for a period of four weeks. Mr. McGibbon plainly indicated that he was prepared for battle, and the representatives of the Loughead estate, tired of the continual strife, relinquished the lease. The estate will provide a wharf north of the present landing place for the accommodation of the ferry. The cost will be about $2,000.

Hamilton, Ont. There are few cities in Canada which are going through this period of depression with less trouble than Hamilton. The value of building permits for the year ending October 31st, 1913, was $5,083,050, being a decrease of $299,850 under that of 1912, and an increase of $909,945 over that of 1911. The bank clearings for the ten months ending October 31st, 1913, were $146,724,735, being an increase of $12,-291,026 over that of the same period in 1912. The following new factories located during 1913: — The Victor Saw Works, Eversharp Pencil Co., Canadian Mantle & Refrigerator Co., Parkes Construction Co., Hamilton Stereotyping & Electrotyping Co., Furnival-New Limited, Hamilton By-Product Coke Oven, Limited. There were also the following new factories or factory additions erected this year: — Laidlaw Bale Tie Co., Co., $18,000; Steel Co. of Canada, $24,-000; Bell Thread Co., $14,000; Fowlers' Canadian Limited, $80,000; Canadian Drawn Steel Co., $3,500; Canada Steel Co., $10,000; Dominion Steel Castings Co., $12,000; Grasselli Chemical Co., $5,000; F. W. Bird & Son, $35,000; Furnival-New Limited, $4,000; Canadian Westinghouse Co., $125,000; Gartshore-Thomson Pipe & Foundry, $5,000; B. Greening Wire Co., $19,000; Hamilton Cotton Co., $6,000; Canadian Cottons, Limited, $28,000; Duncan Lithograph Co., $18,000; Otis Fensom Elevator Co., $40,000; Sawyer Massey Co., $5,000; Boston Insulated Wire Co., $2,000; Lumsden Vinegar Works, $4,500.

Work will be started on the $1,500,-000 by-product coke oven plant in the early spring. This industry will have as much effect on the industrial up-building of Hamilton, as the blast-furnaces and steel plants have had in the past. A start will also be made on the $1,000,000 auxiliary steam plant of the Dominion Power and Transmission Co. A number of the new factories that have been negotiating with the industrial department are expected to have arrangements completed by the Spring.

The Sydney Foundry and Machine Works, Ltd., have just passed the most successful year in the history of their business, and indications point to an even larger expansion during 1914. In the past twelve months, the Company, under the efficient management of W. E. Clarke, have completed their programme of plant extension made public a year ago, and the plant is now one of the most up-to-date structural shops in the East

Geometrical Progression in its Relation to Shop Practice

By John Edgar

The accompanying article is one full of interest to machine tool operators, and, being written in a simple, practical manner, cannot fail to make effective appeal, particularly on account of the widespread concentration of effort put forth to secure maximum quantity and high degree quality output.

IN these days of high speed steels and the modern rush of affairs in the machine shop, where every minute is made to count, the relations of speeds and feeds are of vastly greater importance than was the case in the old days of carbon steels and lax shop methods.

Many shops now have a speed boss, whose only duty it is to see that the work and tools are being run at the most efficient speed as deduced from the experience of past effort on any particular line of work. It is part of the scheme of modern shop management, so-called scientific management. The order of things in a shop so run is to make every move count. In fact, this system of planning every move of the operator is carried to the extreme in many shops, and operator only he really becomes in such a plant, since his work is all schemed out, leaving to him only that which requires muscle and brawn. Cases where the scheme is carried to such an extreme are, however, rare, it being only in shops of large size that these luxuries are found.

The machinist in the small shop can, however, adopt to a large degree such methods in his own particular case and profit by the experience. By planning the job before he commences, laying out a line of operations that are necessary, and carrying these out, he not only gains in experience as an executive, but begins to see wherein methods can be improved and time saved, all of which he could not note if he just takes the job and starts in on the operation that comes first into his head and seems handiest.

Not that the better class of machinist — those who are not machinists long, but who rise—works on such a schedule, because he uses his head a little before jumping in on the job. He always knows that he is right before he proceeds. In this way he accomplishes the same object as those highly systematized shops with their speed bosses, planners and production men; in other words, he does his own thinking, and gets paid for it. To a man of this stamp the relation of speeds and feeds of work and tools is one of great importance, and anything written on this line is sure to be of interest.

Speeds and Feeds.

As manufacturing competition becomes more keen and the profits narrower, the manager must avail himself of every item that will add to the gain column, and must look for every item, no matter how small or trivial which spells loss. In selecting his machinery he is continually on the watch for new ideas that will save a few cents in the manufacture of a part. For this reason a great deal of study has been put into the modern machine tool to aid the operator in getting out a maximum day's work.

It is only in the last few years that any great attention has been paid to the lay-out of speeds for the lathe or milling machine in order to get a graduated progression of speeds and feeds. In most of the older designs the speeds when jumping from open belt to back gears left a large gap or more often overlapped several speeds without uniformity. It was only when study was put into the problem that we began to get machines in which the speeds ran from lowest to highest with even steps.

There has been a lot of discussion on the subject of what is the proper progression of steps in speeds and feeds, and by using a simple line of reasoning we may come to a tolerably correct attitude on this important question.

Lathe Example.

Using the lathe as an example, let us suppose that we have five pieces of work to turn, the diameters being 1 in., 2 in., 5 in., 10 in., and 20 in. respectively. In order that the surface speed be the same in each case, we must revolve the one-inch piece twice as fast as the two-inch piece, because the circumference varies directly as the diameter—that is, the length around the one-inch piece is only one-half that around the two-inch piece. The five-inch piece would revolve only one-fifth as fast as the one-inch piece; the ten-inch piece 1-10, and the 20-inch but 1-20 as fast.

We have seen that the addition of one inch to the diameter of the one-inch piece reduces the speed 100 per cent. If we add one inch to the two-inch piece we reduce the speed 50 per cent., and similarly one inch added to the 5 in., 10 in., and 20 in. pieces reduces speed 20, 10 and 5 per cent. respectively. From this, we see that the speed must vary inversely as the diameter for any given surface speed. It also shows that the speeds vary by small increments at slow speeds, the increment or step gradually increasing as the speeds increase.

Speeds in accordance with the rules of geometrical progression fulfil the requirements of the above conditions.

Application of Geometrical Progression.

If we multiply a number by another number and then multiply the product by the same number and repeat the process a number of times we have in the first number and the succeeding products a series of numbers that are in geometrical progression. Thus 1-2-4-8-16-32 and 64 are all in geometric series, the common multiplier being 2, which is the ratio of the series.

From the foregoing we would expect to find the speeds on a 10-inch engine lathe, with 5 steps on the cone and single back geared, ranging from 21 to 458 revolutions per minute, as tabulated below:

	Open Belt.	Back Geared.
Step 1	548	82
.. 2	325	58
.. 3	230	41.4
.. 4	163	29.4
.. 5	116	20.8

The percentage of increase between the steps is 29 per cent., and the geometric ratio is 1.41.

Milling Machine Example.

The same line of reasoning in favor of the geometrical progression of speeds may be taken in the case of the milling machine. In this case the rotative speed of the cutter is the factor to discuss, and, since these are cylindrical in shape, the increase in speeds follows the same reasoning, and must, therefore, follow in the geometric series. In a milling machine with double back gear and arranged with two counter-shaft speeds ahead, we would expect to find the obtainable speeds arranged in the progression tabulated below:

	OPEN BELT		SMALL RATIO BACK GEARS IN		LARGE RATIO BACK GEARS IN	
Cone	Fast Counter	Slow Counter	Fast Counter	Slow Counter	Fast Counter	Slow Counter
Step 1	223.0	129.0	74.4	43.0	24.85	14.4
Step 2	186.0	107.0	35.8	35.8	20.7	12.0
Step 3	155.0	89.4	51 6	29.8	17.25	10.0
	1.0	2.0	3.0	4.0	5.0	6.0

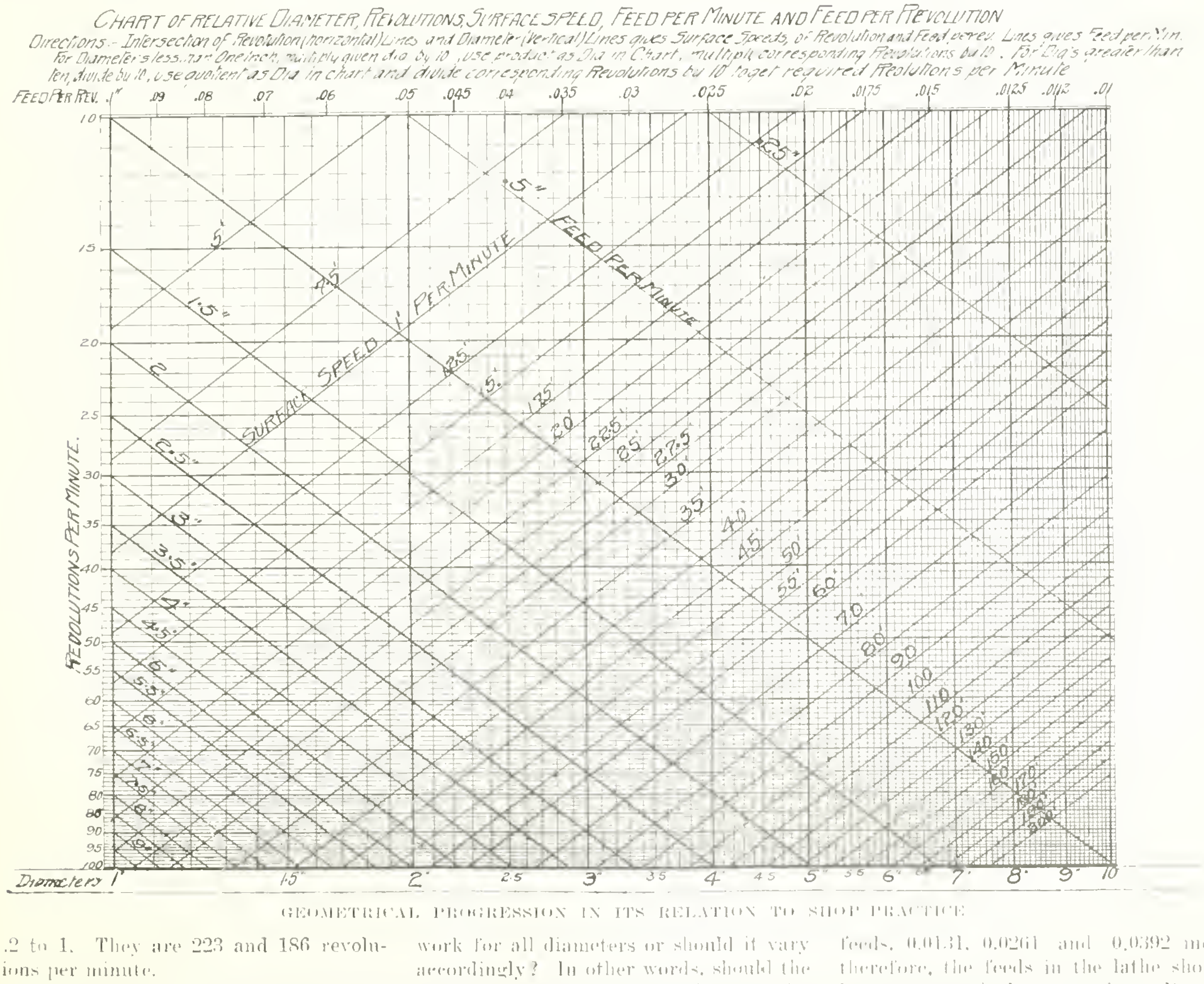
This gives, with a 3-step cone, double back gears and two counter-shaft speeds,

18 changes of speed in a geometric series of 1.2 (approx.) ratio. The arrangement of the steps and the method of changing counter-shaft speeds after the three steps of the cone have been utilized give us a flat cone, or, in other words, one in which the difference between the large and small steps is not great; the difference between the two counter-shaft speeds being 223 and 129, a ratio of 1.725 to 1.

Some drives on milling machines are laid out so that the change in counter-shaft speed is made between the shift of the belt from step to step on the cone: the speeds for such a drive being as follows:

Cone.	OPEN BELT Fast Counter Speed	OPEN BELT Slow Counter Speed	SMALL RATIO GEARS IN Fast Counter Speed	SMALL RATIO GEARS IN Slow Counter Speed	LARGE RATIO GEARS IN Fast Counter Speed	LARGE RATIO GEARS IN Slow Counter Speed
Step 1	223.0	186.0	74.4	62.0	24.85	20.7
Step 2	155.0	129.0	51 6	43.0	17.25	14 4
Step 3	107.0	89 4	35 8	29.8	12.0	10 0

The difference in the large and small steps of the cone are greater in this drive, but the counter-shaft speeds are nearer together, and have a ratio of only



GEOMETRICAL PROGRESSION IN ITS RELATION TO SHOP PRACTICE

1.2 to 1. They are 223 and 186 revolutions per minute.

The former type of drive has the greater popularity, and is no doubt the better when all things are considered, because the belt surface on the cone is larger, giving greater power.

Summing up, we may say that for machine tools where the work or tool revolves as in the lathe, milling machine, boring mill and drill press, the speeds should be arranged in geometrical progression to obtain the best working condition, and that the ratio chosen must depend on the range and size of the machine.

Relationship of Successive Feeds.

In what relation should the successive feeds stand to one another?

Take the case of the lathe again. Here we have the work revolving and the tool advancing at a steady rate per revolution. Now, should the feed be held at the constant rate per revolution of the work for all diameters or should it vary accordingly? In other words, should the feed be 1-32 inch for turning a 1 in. piece, and be 1/4 in. per turn for an 8 in. diameter, or should it be 1-32 in. for the 8 inch piece also?

Let us take three pieces of work, 1-2 and 3 inches in diameter. We turn these pieces at 76.4, 38.2, and 25.5 revolutions per minute respectively, so that we have a surface speed of 20 feet per minute. If we fix the feed at 1 inch per 20 feet of surface, we would have feeds of 0.0131, 0.0261 and 0.0392 inches respectively per revolution of the pieces. Here the feed increases with the diameter of the work, but is constant at 1 in. for every 20 feet of surface that passes the tool, giving an even and equal chip for each case. If we assume a constant feed per revolution, we would have 2.385, 1.193 and 0.796 inch as the respective feeds, and the chip would evidently be greater on the small diameter than on the large.

From this we may take it that the feed should be constant for every foot of surface that passes the tool for like conditions irrespective of the diameter of the work. It will be found that there is a constant ratio between the three feeds, 0.0131, 0.0261 and 0.0392 inch; therefore, the feeds in the lathe should be in geometrical progression. By the

same reasoning we may find that the feeds should also be arranged in geometric series for all machines of the rotative type, as lathes, milling machine, boring mills and drill presses.

Feed Arrangement Systems.

There are now two systems of feed arrangement in use in the milling machine:

The Dependent System.—In this, feeds are obtained by mechanism connected to the spindle of the machine, and any change in the rates of speed of the spindle changes the feed per inch in the same proportion. For this reason it is necessary to provide a range of feeds sufficient to cover the full range of conditions for each spindle speed. This necessitates a ratio of about 100 to 1 for the feeds, and in order that the step between any two feeds may be small enough to be of use, the actual number of feeds must be great. As a result, we have machines on the market with as many as 30 feed changes. This is not the case with the other and later system.

The Independent System.—This independent system is, as the name implies, that in which the feeds are independent of the number of revolutions of the spindle, and any rate of feed per inch is available for use with the whole range of spindle speeds without change. For this reason the ratio of the fastest to the slowest feed is necessarily much lower, and is actually but 30 to 1. This arrangement is only possible with the so-called "single pulley drive," in which the changes in both speeds and feeds are made entirely through two distinct and separate mechanisms driven from one constant speed pulley.

Speed and Feed Combination Considerations.

The question of proper combination of speed and feed to obtain the greatest amount of output is one which is difficult of solution, and can only be solved for any set of conditions; each and every case having a different combination into which the quality of finish, the material used, the material of which the tool is made, the type and rigidity of the machine and a certain immeasurable human element enter to complicate matters. The only correct combination that will give the best results is found from experience.

The Chart Purpose.

To aid the choice of the proper speed for any diameter to give a certain surface speed, the chart is given, in which will be found the surface speed, the diameter and revolutions per minute for a wide range of conditions.

To find the proper number of revolutions at which the work should run, trace the diameter down the vertical line to the intersection with oblique line representing the surface speed; the horizontal line through this intersection represents the revo'utions per minute to the scale at the left. Thus, a piece of work 6 in. in diameter to run at 45 feet per minute should revolve 29 turns per minute.

The range of the chart is unlimited, except as to surface speeds, of which a wide range are incorporated. Thus, what speed should a ½ in. cutter turn to give 30 feet per minute at the periphery. This being less than one inch, take the chart to read 100th inches where inches now show, and we have the intersection of the surface speed and diameter lines at about 23 on the left hand scale, but as the diameter is only one-tenth, the revolutions must be ten times the scale, giving us 230 r.p.m. as the required speed.

The chart also gives the feed per revolution and feed per minute for any given revolutions per minute, so that we may obtain the revolutions per minute and the feed per revolution for any given diameter, surface speed and feed per minute. As an example, take a cutter 3 in. in diameter working at 45 feet per minute and a feed of 3 in. per minute. The required r.p.m. are 57, and the feed per revolution .0675 inches.

This chart will be found very handy, and when accustomed to reading it, which is very simple, will save a lot of time.

THE L. S. STARRETT CO. TO THEIR EMPLOYEES.

LAST December, after twelve months of steady increase in our sales over the business of the corresponding months of the year before, we took pleasure in notifying you of a vote of the Directors to pay to each employee a sum equal to two per cent. of the total wages paid him during the year, which, for those who had worked here the full year, meant about one week's extra pay.

The conditions at this time are somewhat different. The sales for the first six months of the year showed a gratifying gain over the corresponding months of last year, but the business of July and the following months has been less than it was in the corresponding months of last year. The decrease in business the latter part of the year is in keeping with the general depression throughout the country following the change in administration and the passage of a low tariff law, but fortunately we have not felt the effects of this depression nearly so much as many others, especially those in the machine tool line; and in fact, in spite of somewhat decreased sales we have not been able to bring our stock of goods on hand up to the condition it should be in, to meet the heavy demands on it which we are confident the early spring trade will bring.

The continued harmony and co-operation between all parts of our organization is very gratifying to us. It is gratifying that this idea is becoming more firmly rooted in the mind of each employee—that Starrett Tools must be right, and that everyone of us has his part to do in making and keeping them right; that economy in production and the elimination of waste in material, time and labor are to be constantly striven for; but that the one great essential in the making of Starrett Tools is quality.

At this Christmas time we wish you all happiness, and take pleasure in informing you that at the meeting of the Directors of this Company held on the 10th instant, a vote was passed similar to that of last year, namely, that this Company pay, as soon after the first day of January, 1914, as practicable, to each person in the employ of the company on that date, a sum equal to two per cent. of the entire amount of wages paid to such employee during the year 1913.

SKINNER CHUCK CO. BANQUETS EMPLOYEES.

IN these days when there is so much talk about capital oppressing labor, it is quite refreshing to find an instance where the labor and capital meet on the friendliest of terms and partake of the same food from the same table. That is exactly what happened on the night of December 23, when the Skinner Chuck Co., New Britain, Conn., tendered its annual banquet to its employes at the New Britain club. There were 120 men present and Professor David N. Camp, President of the Company was the principal speaker and the honored guest of the evening. Mr. Camp will soon pass his ninety-fourth milestone, a fact that made the presence of this venerable gentleman the more notable. The following invitation was sent out by the Company, and most of the recipients accepted:

"You are cordially invited to be present at a dinner for the employes of the Skinner Chuck Company at 7.30 o'clock at the New Britain Club. It is hoped every employe will be present. Wishing you a merry Christmas and a happy New Year; very truly yours, the Skinner Chuck Company."

Ovation for Guest of Honor.

When Mr. Camp entered the banquet hall he was given a rousing welcome and for several moments the cheers of the diners rang throughout the outer corridors. Deacon Camp was greatly touched by this demonstration of affection and controlled his emotions with difficulty. Secretary E. J. Skinner was toastmaster, and those who responded to toasts were Superintendent A. A. North, Harry Hancock, Joel Bloomquist, Treasurer D. O. Rogers, Joseph Preissel and others. Throughout the evening Lynch's orchestra furnished the music.

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

REORGANIZING THE BELTING DEPARTMENT. OF A MACHINE SHOP.

By H. Womersley.

ABOUT three years ago I took charge of a machine shop and was told that any improvements I wished to introduce would be welcomed. I can assure you there was plenty of scope. The belting was in a deplorable condition, so I decided to tackle it first, and what follows is an outline of how I proceeded to bring this important equipment to a proper state of efficiency.

I entrusted the care of all belts to one man and held him responsible for all repairs, alterations and dressings. Notices regarding this were posted throughout the shop. The belt man was supplied with the necessary tools, which consisted of clamps and rods, belt scraper, knife sharpener, awl, drive punch, blind punch, staple puller, pegging hammer, brush for compound, etc.; also a compound for preserving leather belts made from the following:—Two quarts castor oil, 1 lb. tallow, 1 oz. powdered resin, 2 oz. hard soap, melted and mixed together.

I next instructed him as to how I wanted the belts repaired and cleaned, and informed him that he must make a careful inspection of all belts at frequent intervals and keep a record of same. His inspection must cover such points as general condition, whether overdry, or saturated with oil; whether any laps had begun to start open, or whether a belt needed early replacement.

If the belt were dry or harsh he was to first clean off the surface dirt, this being accomplished by means of a cloth, damped in kerosene, if need be. In bad cases, the belt was to be scraped; the ideal aimed at being a clean leather surface. A light application of dressing was to follow. For greasy belts, wiping on the pulleys with a dry cloth or some absorbent material would help, but, if possible to remove the belt, packing in dry sawdust or shavings was recommended for the purpose of absorbing the oil. An excess of oil, it should be explained, tends to rot the leather.

Jointing Belts.

I next instructed him on jointing belts, and as I have a fancy for the "hinge" style, I showed him how to make that joint as follows:

Cut the ends of belt to be joined perfectly true with a tee square.

Punch two rows of holes in each end of the belt, care being taken that the holes are not opposite each other, and that one of the ends contains one more hole than the other.

No hole should be less than ½ in. from the edge of the belt, and no nearer than ¼ in. to the end. The second row must be 1 in. from the end alternate with the first row. A good rule is as follows:—

2 in. to 2½ in.	3 holes.
3 in. to 4 in.	5 "
5 in.	7 "
6 in.	9 "
8 in.	13 "
10 in.	15 "
12 in.	17 "

Width of Belt Lacing.

Up to 5 in.—¼ in. and 5-16 in.
6 in. to 14 in.—⅜ in. and ½ in.
14 in. and over.—⅝ in.

Begin to lace by drawing half the lace through the centre hole. If you commence with the upper end of lace, pass it over the one, and under the other end of belt, and continue in this way, over and under until the last hole is reached; then fasten your lace in the usual manner. When you commence to lace with the lower half of lace, follow same method, except that you pass the lace under the one and over the other end down through the hole from the opposite side of belt. Both sides of belt show lacing to be alike. This plan of lacing produces pliable joints.

Next avoid putting on belts too tight. The proper tension is of fundamental importance. If too tight, there is a large unnecessary loss of power from excessive friction. On the other hand, if too slack, the belt is liable to flop around and jump off the pulleys when a load is suddenly thrown on and off.

I also pointed out to him that single belts should be put on to run with the grain or hair side, next to the pulleys, and so that the joints of the laps run against the pulleys, as the laps on the outside of a belt are most liable to come apart when the joints are run against the atmospheric pressure. Double belts should be put on so that the points of the laps run with the pulleys, as both sides point in the same direction.

Belting Rules.

I wrote him out the following rules regarding belting:—

To find the Velocity of Belting—Multiply the diameter of the pulley in feet by 3.1416, and again by the revolutions of the pulley.

To Find the H.P. of Belting—Multiply the velocity by the width of the belt in inches, and that product by 50 for single, 80 for double, and by 100 for three ply. Divide this product by 33,000 and the quotient will be the H.P. which a good belt can safely transmit.

To Find the Width of Belting—Multiply the given H.P. by 33,000, and divide this product by the product of the velocity multiplied by 50 for single, 80 for double, and 100 for three ply.

To find the length of belts when it is inconvenient to use a tape:

(a)—When both pulleys are of about the same size. Add the diameter of the two pulleys together; multiply this result by 3.1416, and divide by 2. To this quotient add twice the distance between centres of the shafts, and this will give the required length.

(b)—When one pulley is considerably larger than the others. Square the distance between the centres of the shaft; add to this the square of the difference between the radii of the two pulleys, and from this total extract the square root and multiply by 2, thus acquiring the total (M). Add the diameters of the two pulleys together and multiply this total by 3.1416, then add to one-half of this result the total (M), and you get length required.

(c)—For cross belts.—Square the diameter of the large pulley and the distance between centres, add together and extract square root. Square the diameter of the small pulley and the distance between centres; add together and extract square root. To the sum of the two roots, add one-half the circumference of the two pulleys, when the total will be the required length.

I must confess here that this beltman turned out to be a very good man, for after this system had been in operation two years, the principal of the firm made this statement to me:

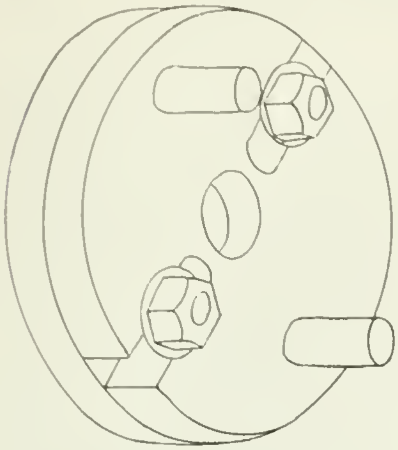
Your system of belt repair is a great success, because it minimizes machine stoppages, the leather bill is going down, less repairs seem to be necessary to shafting, also, the appearance of belts repaired in a uniform manner is not an eyesore as formerly.

TWO LATHE KINKS.

By J. D. Cooper.

IT is acknowledged by all good lathe men that for accurate turning on nice work it is better to have it driven from each side by two-tail dogs, and to be sure that each end drives an equal amount.

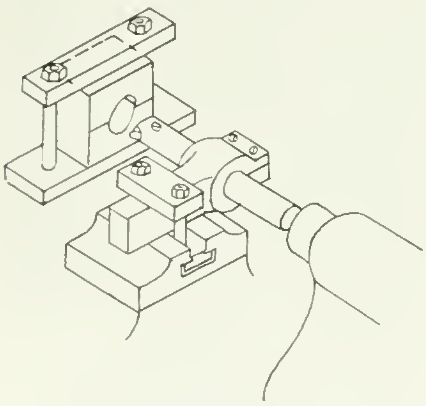
One of the best methods of insuring this is to use what is known as the equalizing face plate, Fig. 1. This consists of an additional plate on the regular face plate as shown, and held to it by the two studs



EQUAL DRIVE FACE PLATE.

working in the slot in the outside plate. The lathe centre comes through in the usual way, and the outer plate is left loose enough to adjust itself, so that each of the driving studs (A) and (B) will bear with equal pressure on the two ends of the dogs. This insures an even driving pressure and avoids the tendency to crowd the work to one side, which is sometimes found where the bent-tail dog is used, or even the single straight-tail.

One of the essential features in using the boring bar in the lathe is to have the bar supported as close to the cutting edge as possible, and Fig. 2 shows a method which is used by some tool makers with considerable success. To begin with, the work is clamped to an angle plate fastened to the face plate, so that it can be clamped perfectly square with the latter, and not sprung, as is sometimes the case when we attempt to pull the work back against the face plate by two or more bolts.



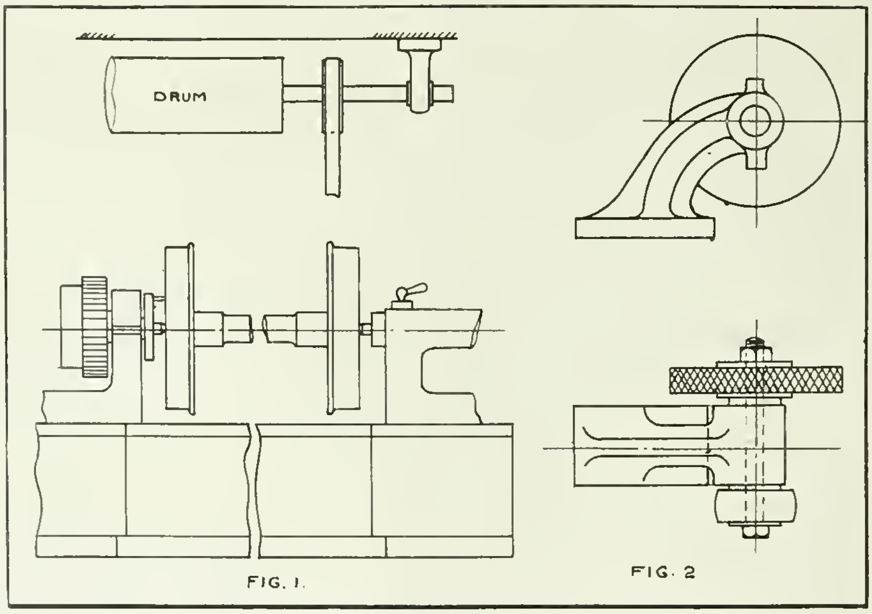
USING BORING BAR IN LATHE.

As shown, the boring tool (A) is clamped in the holder (B) so that the tool block and carriage travel with the bar when fed into the work by the tail spindle (C). In some cases the tail spindle is not used for this purpose, and the bar is fed into the work solely by the carriage. Another way which is advocated by many lathe men is to move the holder (B) as close to the work as possible and feed the bar (A) through it by the tailstock (C), as this keeps the support close to the outside of the work at all times. On the other hand, it allows the tool to spring more as it gets farther into the hole, for the cutting point is constantly going away from the support to the bar, while if it be clamped in the holder, the cutting point is at a constant distance from its support at all times, so that the spring of the bar should be practically constant.

TRUCK WHEEL AXLE GRINDING.

By "Beechmount."

GENERALLY, when truck wheels come into the shop to be trued-up, we find the bearing on the axle out of true. The amount of material to come off is, however, so small that grinding is the means usually adopted. A difficulty arises when the truck wheel lathe is not adapted "as regards speed" for trueing-up the bearings.



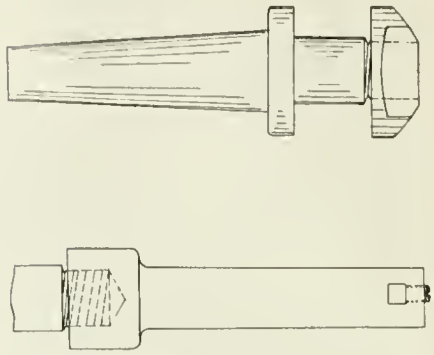
TRUCK WHEEL AXLE GRINDING

To overcome this, rig-up an arrangement as indicated by Fig. 1, throw off the machine driving belt, drive off pulley to wheel, and use grinder as shown in Fig. 2 to true-up axle.

STUB ARBORS AND BORING HEAD.

By D. A. Hampson.

FOR a goodly proportion of milling work, both manufacturing and jobbing, the usual full length arbor has its disadvantages. The class of work, which is produced by a single cutter or a few cutters in a compact cluster, and which is of a form that can be set well up toward the head of the machine, may be performed as well and better by using a short or stub arbor.



STUB ARBORS AND BORING HEAD.

The advantages of a stub arbor are that fewer collars have to be removed and set every time a change of cutters is made, the absence of a tailstock to set each time and to keep lubricated, the space for work pieces, jigs, and clamps which the short arbor permits, and the general freedom with which work may be handled when the long arbor and its support are dispensed with. All of these make for increased production and decreased cost.

If the cutters are provided with keyways, and all cutters should be in these days, the nut at the end of the arbor can be made very narrow, if the work demands it, a nut of but two threads being sufficient to hold the cutters together properly. Several lengths of stub arbors are handy to have on hand. For a 1-in. arbor, length of 1 in., 2 in., and 4 in., are most useful, while special arbors for special jobs might well exceed these sizes.

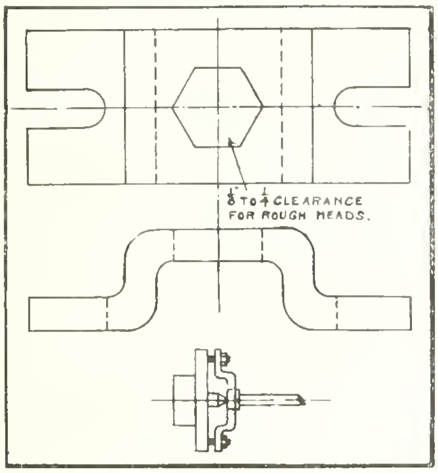
Milling Machine Tools.

In connection with stub arbors, a convenient boring head may be devised as illustrated. This has an enlarged end which is threaded out to fit the nut end of the arbor. It carries at its free end a fly cutter set square or on an angle as desired. Such a boring head is inexpensive, quickly applied, and reasonably stiff. Not infrequently, we encounter a piece of work that has to be milled and bored at a single setting. This stub arbor and boring head combination will do many such jobs without removing the arbor from the machine and do them as well as much more expensive tool outfit.

BOLT DRIVER.

By H. W.

THE sketch shows a very efficient bolt driver, due to the fact of the bolt being easily and quickly removed. The



BOLT DRIVER.

driver adjusts itself to the head of the bolt and also keeps the lathe balanced when running at high speeds. A variety of size is, of course, necessary to suit particular bolts.

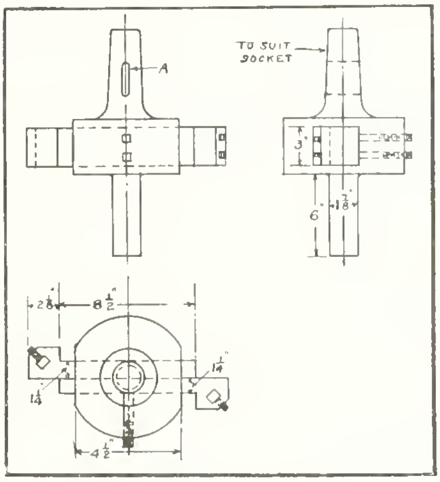
TAPER TURNING ARRANGEMENT.

By W. Womersley.

WHEN the lathe has no special taper turning arrangement, the rig here described and illustrated can be readily applied. The handwheel is removed and replaced by a hardwood disc (S), with a run groove for a stout cord (A). One end of this cord is attached to the tailstock at (B) by means of a bent metal strip D. The conicity or degree of taper will be determined by the diameter of the disc (S).

BORING ADJUSTABLE CUTTER HEAD.

THE cutter head here illustrated is a simple and strong tool for producing 6 in. to 16 in. holes from the solid after



BORING ADJUSTABLE CUTTER HEAD.

drilling the guide hole. This method permits the use of short and rigid tools. It is generally advisable to help the drive with a cotter at (A), as great pressure is put on the shank when cutting out 16-inch holes.

MOVING HEAVY OBJECTS.

By D. S. Mann.

IN moving heavy materials, such as machinery, marble, etc., where rollers are used on wooden timbers, the rollers are found to sink into the wood slightly and often sufficiently to practically prevent the movement. Where a block and tackle is used for pulling, it will often be found that the object will slide on the rollers before they will turn. In such cases it will greatly expedite matters if a pipe wrench is put on each end of the roller and used to propel the same. The results will be surprising and two men with ordinary pipe wrenches can walk a tremendous load up a good incline without any trouble. Of course, some means should be provided to hold the load. The rollers having such a short radius, the leverage gained is great and the action is the same as that of a self-propelled vehicle.

SITE BOUGHT FOR DRYDOCK.

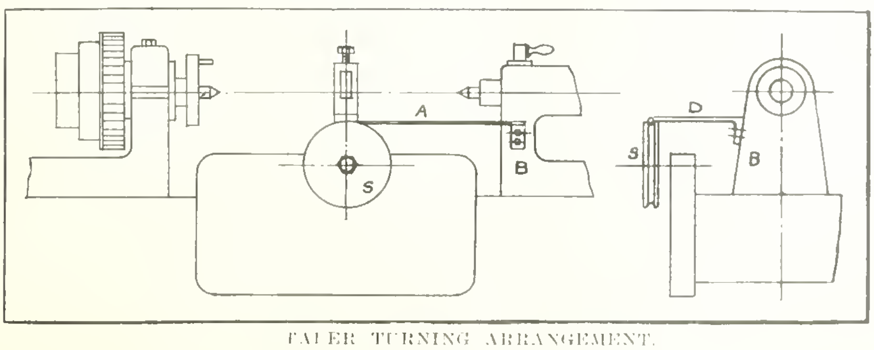
THE Government has purchased from the Bullen Marine interests on Lang's Cove, Esquimalt, B.C., a site for the Government drydock for the Pacific Coast, as promised some months ago. The plans for the drydock are now being prepared by the Public Works Department engineers, and it is expected that tenders will be called for early in the spring.

The estimated cost of the drydock is approximately four million dollars. It will be of the same dimensions as the new Government drydock at Levis, now under way, and will be capable of accommodating the largest vessels afloat. The dimensions are: Length, 1,150 feet; depth, 40 feet, and width, 120 feet. It is understood that a similar drydock is to be built at Halifax.

The building of these three drydocks will meet a long-standing need in Canada for ship repairing facilities both on the Pacific and Atlantic coasts, and will lay the foundation for the resuscitation of the Canadian shipbuilding industry. Moreover, the policy of constructing big Government drydocks on both coasts is in line with the needs of a Canadian naval defence policy along the lines of the Naval Service Act of 1910. Towards the ultimate adoption of this policy the Government is being steadily compelled by the force of national opinion and by the logic of international developments.

The drydock proposals, with a strengthening of the coast defences at Halifax and Esquimalt, are likely to be the Government's only practical move towards naval defence during the coming session.

C. P. R. Apprentices.—The annual presentation of scholarships in connection with apprentice instruction classes at the Winnipeg C. P. R. shops took place in the schoolroom on the afternoon of Tuesday, Dec. 23. There were over one hundred apprentices present. R. A. Pyne, superintendent of shops, presided. The company grants five free scholarships annually, and these are keenly competed for by the apprentices. The winners for this year were: Thomas Howe, apprentice blacksmith; Donald Chapman, apprentice machinist; Harry Waller, apprentice machinist; Charles Powles, apprentice machinist; Ralph Wade, apprentice coach carpenter.



TAPER TURNING ARRANGEMENT.

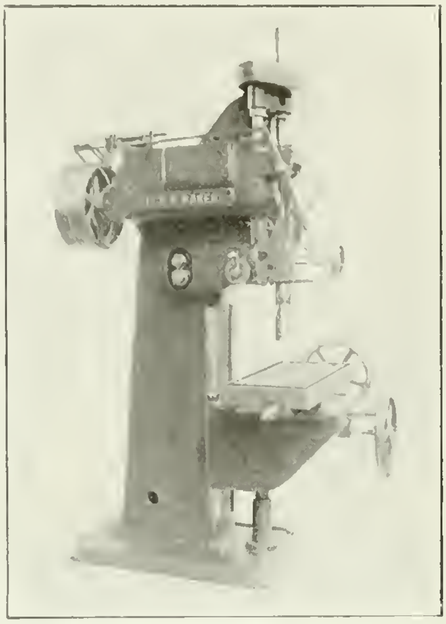
DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

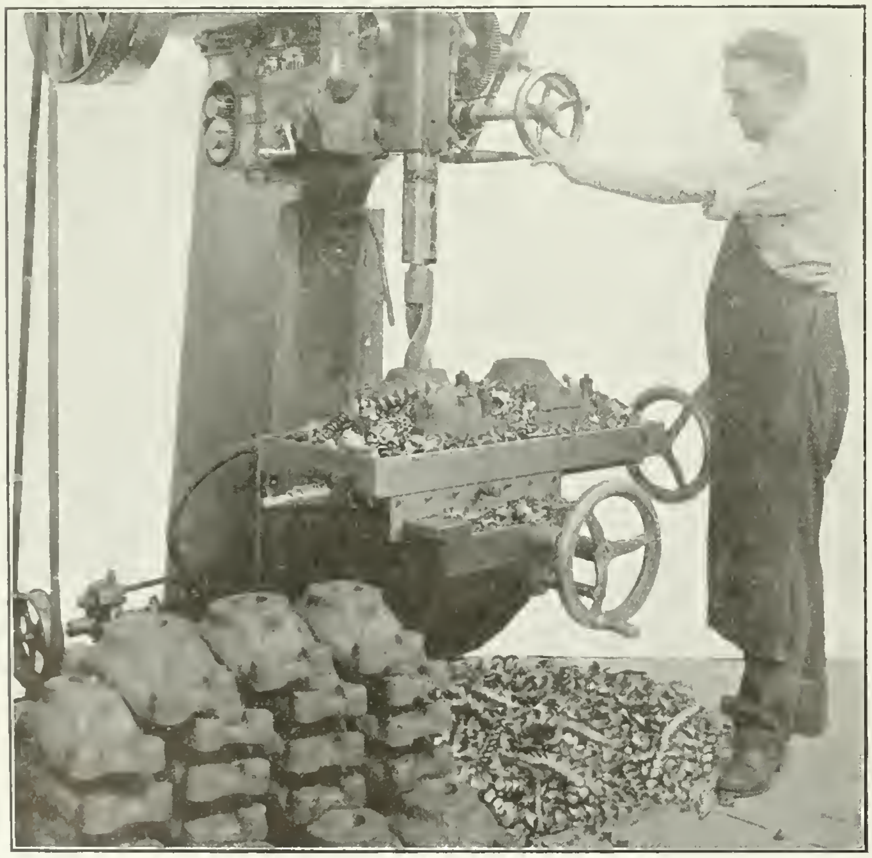
HIGH SPEED DRILL.

THE three photographs show the construction of a high speed drill, ball bearing, built by Baker Brothers, Toledo, Ohio. The machine is styled No. 1-B. The speed changes are obtained through hardened sliding gears mounted on ball bearings. This ensures a great durability and at the same time high efficiency. It may be noted that in securing the desired six speeds there are no idler gears running, only one pair of gears being in mesh in the gear box at any one time. The minimum number of gears in mesh at one time not only increases the efficiency of the machine materially, but gives long life and durability, which is essential, as the punishment received in the hands of the average drill press hand is severe.

Two of the photographs show the machine in operation on actual work. In one view, it is shown with a plain table drilling a 2½ in. hole through a hammered steel forging 14 in. long. A 1⅛ in. hole was first drilled through the forging. The 2½ in. hole was next drilled, taking five minutes. The hole was then enlarged to 4 in. diameter, 4 in. deep, the time required being 4½ minutes. The other photograph shows the machine drilling drop forged iron saddles with 2½ in. hole, 2¾ in. deep. These were drilled in 37½ seconds.



BALL BEARING HIGH SPEED DRILL.



DRILL IN OPERATION.

The compound table with screw adjustments is a feature worthy of note, the adjustments being smooth, rapid and positive. Another feature of interest in this machine is the speed range. This as nearly as possible corresponds to the proposed "chromatic scale" of speeds being advocated by some of our noted efficiency engineers.

All gears in driving train except large top driving gear are of steel, oil treated and hardened. They run in bath of oil, and are protected by suitable guards. The spindle is made from high carbon, hammered spindle steel forgings, and the thrust is taken on high duty ball bearings. The spindle has six speeds:—500-369-258-179-130 and 92.5, any one of which may be obtained instantly by means of sliding gears controlled by one lever within easy reach of operator. These are in dive keys or tumbler gears in driving train. The shafts are mounted on high duty radial bearings, all enclosed in an oil-tight case.

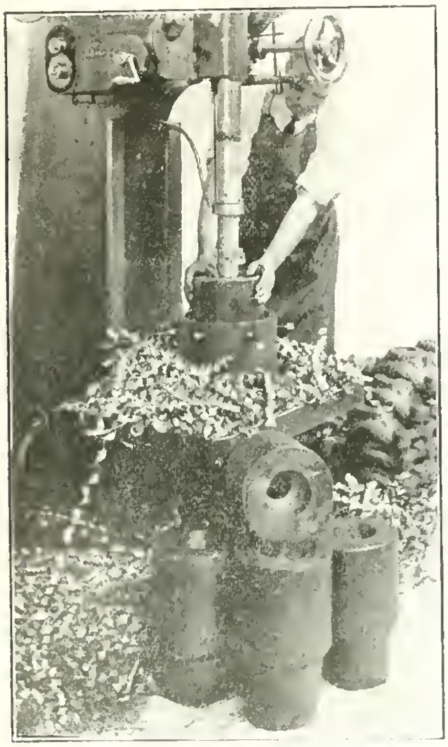
The spindle has vertical feed of 16 in. and is equipped with depth stop. There are twelve changes of feed per revolution of spindle as follows:—.006, .007, .008, .010, .012, .013, .015, .017, .020, .024, .028, .032 inches, all obtained by means of powerful dive-key and quick change slip gears. A safety device on spindle feed shaft is provided to protect feeding mechanism from injury, and to provide uniform wear of large worm gear.

The plain table, 24 in. x 29 in., is of box knee type, heavily ribbed, and screw elevating.

The compound table is also of box knee type, heavily ribbed, with screw adjustments in all directions. Micrometer collars are provided for in and out, and cross movements. With the screw adjustments, it is not necessary to lock the tables in position after adjustments have been made. Fine adjustments can also be made, at the same time being very rapid. The size of the compound table is 16 in. x 36 in.

The swing is 24½ in., i.e., 12¼ in. from centre of spindle to column. Provision is made for a 3 in. single belt

drive running on an 18 in. diameter pulley, at 475 r.p.m. direct from line shaft. For motor drive, a 10 h.p. motor is placed on the floor directly back of machine, no alterations being required for

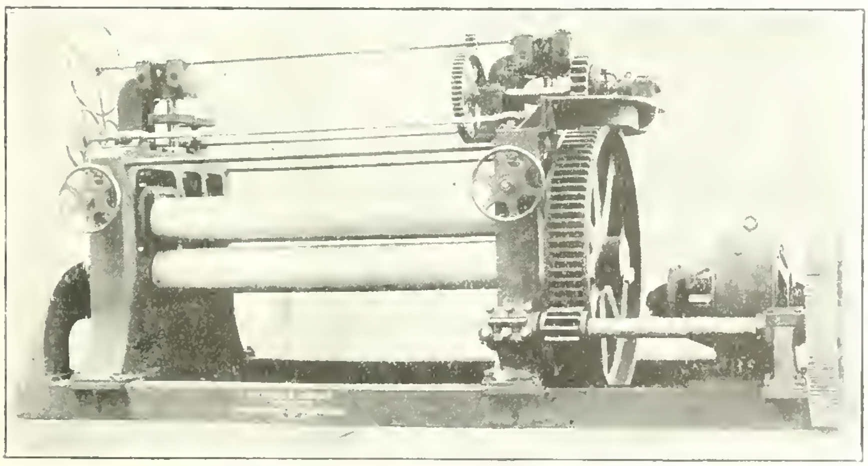


DRILL IN OPERATION.

changing to the latter except the belt shifter. An oil pump of proper size, complete with tank and all necessary piping, is included in the equipment.

LARGE PLATE STRAIGHTENING MACHINE

THE accompanying illustration shows what is considered to be the largest plate straightening machine ever built. It can straighten cold plates of $3\frac{1}{2}$', nickel steel, $1\frac{3}{8}$ inches thick and 10 feet wide. The motive power is a 100 h.p Westinghouse motor. Hilles & Jones Co., Wilmington, Del., are the manufacturers of this machine.



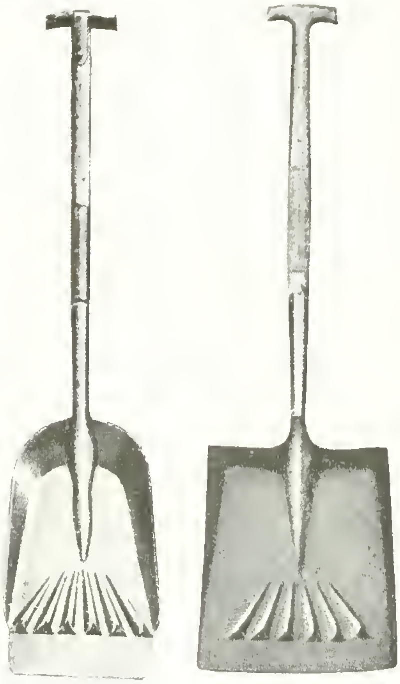
LARGE PLATE STRAIGHTENING MACHINE.

SPRINKLING SHOVEL FOR BOILER FIRING.

IN the December, 1913, issue of The Power House there appeared an article, entitled "Improved Hand Firing," the substance of which was the adoption for steam boiler firing purposes of a special type shovel designed to sprinkle the fresh fuel over the fire grate. Mr. C. A. Fell, Sheffield, England, a specialist in the subject of fuel economy, developed this particular type appliance, and it is of interest to know that George A. Marshall, 70 Lombard Street, Toronto, is distributing agent for it in Canada.

By means of the fan-shaped projection on the firing surface of the shovel, the fuel is spread so finely over the fire that the gas is driven off suddenly and ignites very quickly. In this way the furnace temperature is kept up to a maximum and so far from an extra supply of air being necessary, the draught may be lessened by partly closing a damper. The shovel is designed to get a similar effect as with a mechanical stoker of the sprinkling type, and thus the amount of steam generated in the boiler is increased by the sprinkling action without the necessity of going to the high first cost of the mechanical stoker. This is particularly advantageous in districts where manual labor for stoking is cheap, while the cost of buying, transporting and erecting a mechanical stoker would be correspondingly heavy.

It may be argued that the fire needs firing oftener, and, therefore, the fire door has to be opened oftener, but the door is not kept open for such long intervals at a time owing to a less number of shovelsful being necessary to cover the fire. Further, owing to the thin layer of fire used, it is not necessary to open the fire doors so often for raking, slicing and poking. Again, as less draught is necessary, there is obviously a less quantity of excess air drawn through the flue when the fire



SPRINKLING SHOVEL.

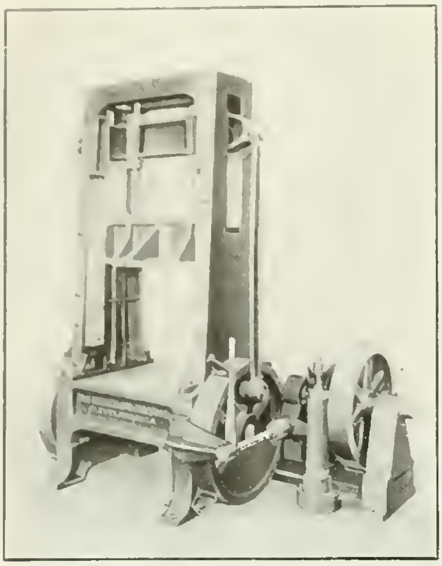
door is opened, and, therefore, the boiler and its setting is not cooled down to such an extent during the firing and raking operations.

This simple modification of the ordinary firing shovel is a distinct step in the direction of boiler economy, and has the additional advantage of training the fireman automatically in the production of a high rate of steaming.

A NEW WIRING PRESS.

A NEW long stroke wiring and forming press as illustrated has recently been developed and put on the market by the Cleveland Machine & Mfg. Co., Cleveland, Ohio. This machine is intended for deep forming of light sheet metal parts, and for wiring the edges of wash tubs, water pails, ash cans and similar articles. The bed area is 32 inches front to back by 32 inches right to left, and the stroke of slide, 20 inches, gives plenty of room for handling the work at high speed. To secure a rigid frame and proper gib arrangement, the uprights or housings are made very deep, front to back, and heavily ribbed. Lugs on the back of the gibs fit in cored pockets in the housings and take the pressure of the adjusting screws. This construction gives an unusually good bearing for the slide and at the same time permits the latter to be removed from the machine without taking down the housings.

The machine is double geared, with a ratio of 10 to 1. The drive is by belt through a 30-in. x 5-in. fly wheel which acts as a pulley. A cone friction clutch mounted in the fly wheel is operated by a cam on the main shaft under the bed, which automatically releases the clutch on the up stroke and applies a brake to



A NEW WIRING PRESS.

the driving shaft. Pressure on the foot treadle releases the brake, and the clutch is thrown in by a weight, which is cushioned in the dash pot.

For purposes of setting dies, the automatic arrangement of clutch can be disengaged by loosening a nut on the lever shaft, and the machine can then be operated by means of the hand lever. The total weight of the machine is 7,000 lbs.

MULTIPLE RADIAL DRILL.

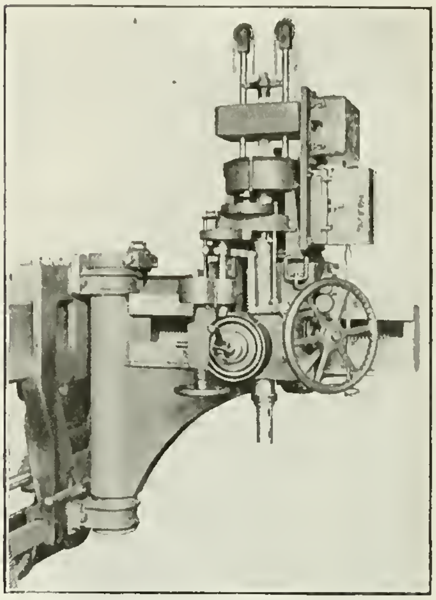
THIS machine has four radial arms mounted on one long cross-rail with lateral traverse by power in addition to radial and in and out movements of the arm and spindle head. Each head carries its own driving motor and all movements of each head are controlled by the operator from his position in front of the spindle.

The spindle heads have adjustable steel rollers running on the wide top track of the arm providing easy movement by the hand wheel and worm in an angle rack. The variable speed motor is mounted on the back of the head behind the arm and the controller handle is brought down behind the traverse wheel. The gearing from the motor has two changes by a positive tooth clutch operated by a lever on the left side of the head. The spindles are forged from high carbon steel, have a large diameter in the sleeve and a squared upper end for the driving gear. Ball bearings are provided for drilling thrust, and under the counter weight yoke.

The feed has three changes by selective pin, and is driven by gears from the spindle through a safety friction. A positive tooth clutch controlling the feed worm can be operated either by hand or automatic trip. A wheel is provided on the worm for hand feed and the rack pinion is connected to the worm gear by a quickly operated saw tooth clutch and hand lever for spindle return.

The arms are of heavy box section and are mounted on the saddles by roller and ball-thrust trunnion bearings. The binder on the top trunnion is operated with air by a hose connection to a valve on the spindle head. The saddles have a long bearing on the top rail to prevent tipping, with support against the lower rail for drilling thrust. The power traverse gearing is carried on each saddle, permitting independent motion in either direction by means of a double clutch between bevel gears. The motor for driving traverse operating shaft is located at the left end of the base, and has sufficient power to move all heads at one time.

The cross-rail is made double, the top part carrying the direct load and side strain, and the bottom taking the drilling thrusts. These rails are securely fastened on five heavy box section uprights which are mounted on a deep and heavily ribbed cast iron base running parallel with the cross-rail. Five cast iron sub-bases support both the cross-rail and table and are to be bedded below the floor level.

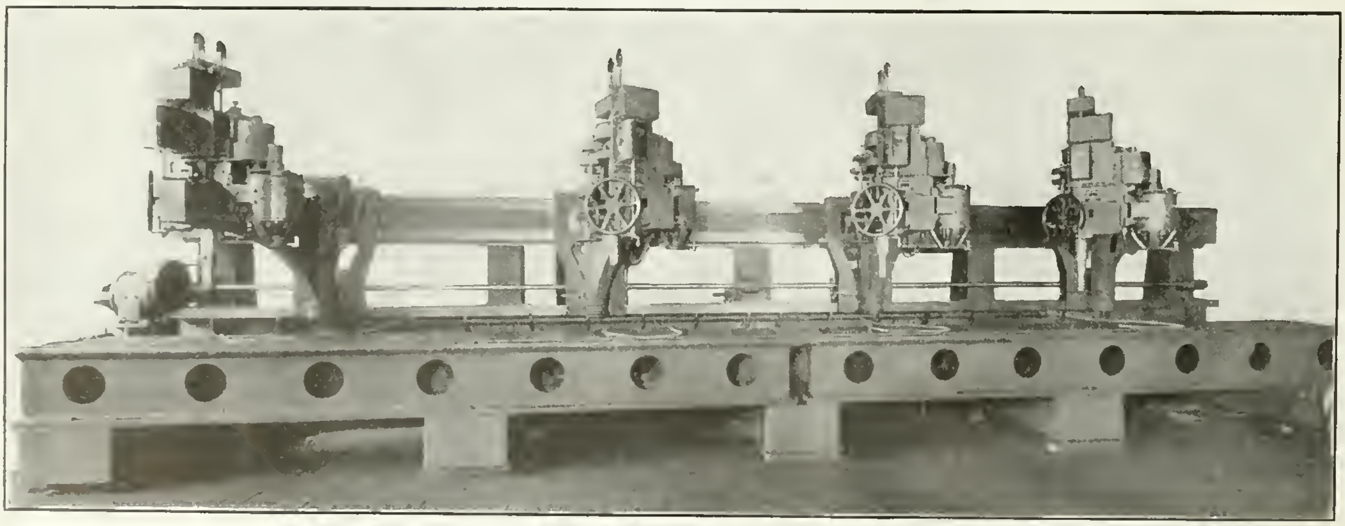


MULTIPLE RADIAL DRILL DETAIL.

The table is made in two parts joined in the centre to make one continuous surface.

The drilling capacity in steel at 65 feet per minute is $1\frac{1}{2}$ inches; the spindle speeds are 75 to 300 r.p.m.; the feeds per revolution are .005, .009 and .015 inches; the size and speed of motor on heads, $7\frac{1}{2}$ h.p. and 825 to 1,650 r.p.m. respectively; the size and speed of traverse motor, $7\frac{1}{2}$ h.p., 750 r.p.m.; extreme space 43 ft. 4 in. by 9 ft. 9 ins.; height over all, 10 ft. $5\frac{1}{2}$ in.; and weight, including motors, 85,500 lbs.

Edwin Harrington, Son & Co., incorp., Philadelphia, Pa., are the builders of this machine which is known as their No. 32, Multiple Radial Drill.



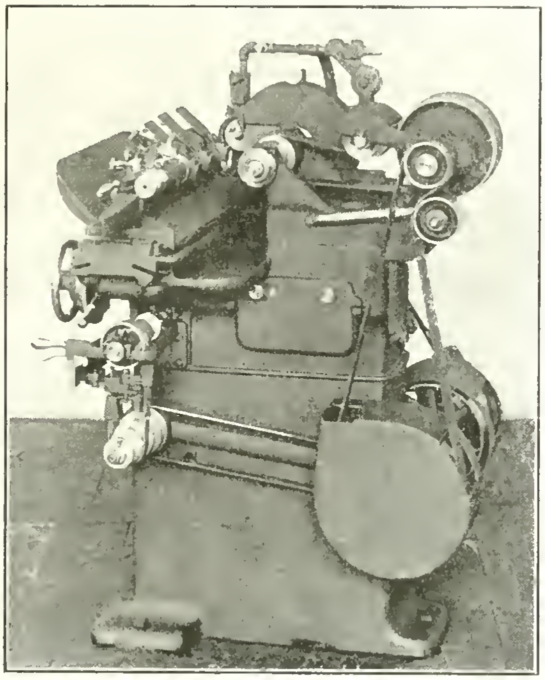
HARRINGTON MULTIPLE RADIAL DRILL.

NORTON 3-IN. x 18-IN. PLAIN GRINDING MACHINE.

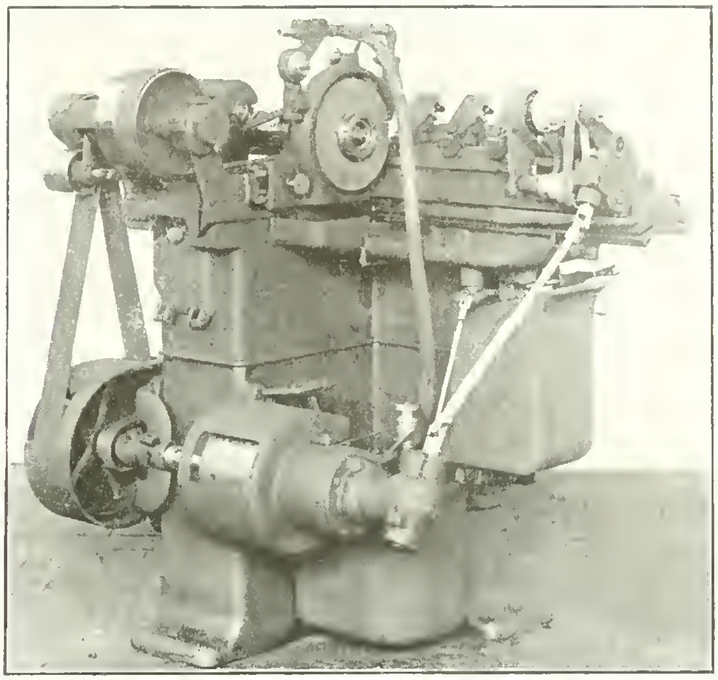
THE Norton Grinding Co., Worcester, Mass., are putting on the market a small machine for grinding cylindrical work, which machine will be known as the 3 in. x 18 in. Norton Plain Grinding Machine. It is made to swing 3 in. in diameter in order to give room for suitable steadyrests for supporting work from $1/8$-in. diameter to 1-in. diameter, and up to 18 in. in length, but is best suited for work from $1/8$-in. to $1/2$-in. diameter. It is designed for finishing cuts only, where there is not more than .004 in. to .008 in. stock to be removed from the diameter of the work. This machine is especially useful on the grinding of such work as small twist drills, tool work, typewriter, sewing machine, phonograph, cream separator, roller bearing, and electrical apparatus parts.

The design is novel in that the machine is self-contained, no overhead works being required. It can be driven by belt either from above or below, or by a motor placed on the floor at the back of the machine. The table reverse is pneumatically cushioned, making it possible to operate the table at a maximum speed of 27 feet per minute. There are 8 table speeds provided, the slowest being 17 inches per minute. The automatic and hand cross feed, while of entirely new design, sacrifice nothing in the matter of accuracy in sizing the work. The control of the work revolution and table traverse is unique in that while either can be started separately or simultaneously, the stopping of the work always stops the table, and the table cannot be

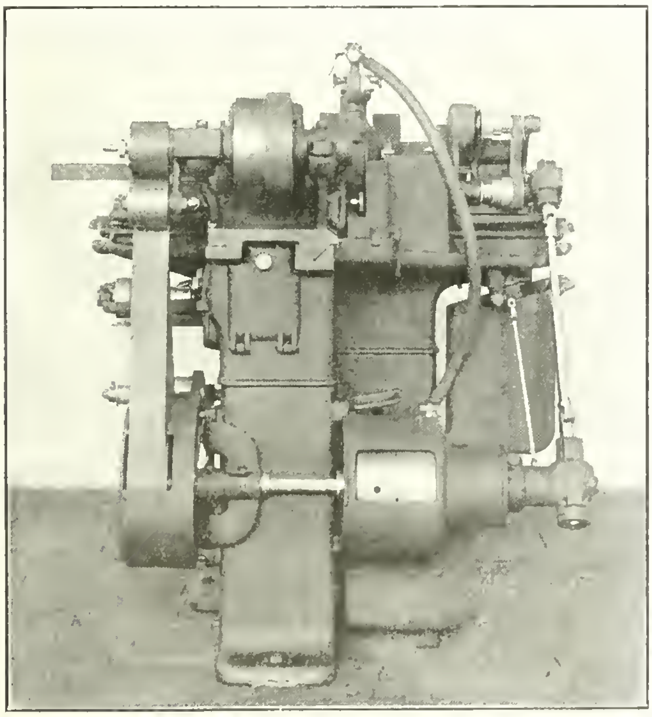
(Continued on page 47.)



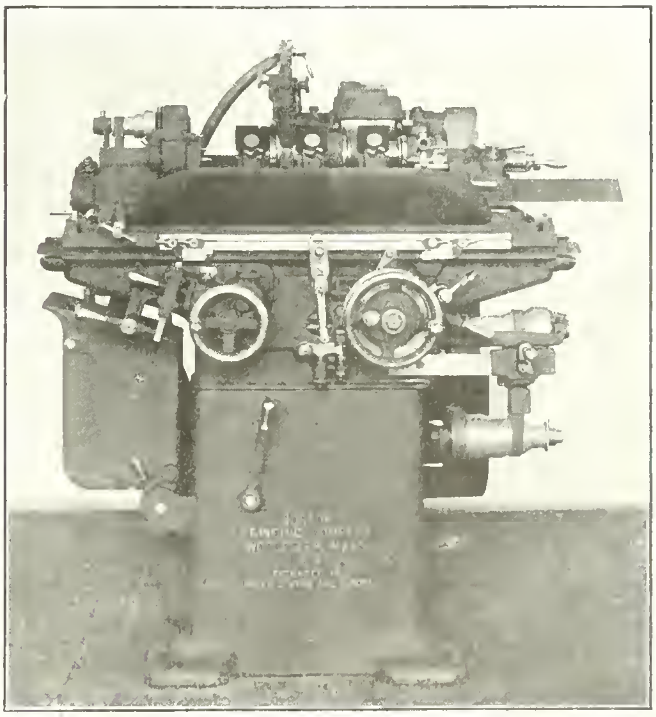
NORTON GRINDING MACHINE—RIGHT-HAND END VIEW.



NORTON GRINDING MACHINE—LEFT-HAND END VIEW.



NORTON GRINDING MACHINE—REAR VIEW.



NORTON GRINDING MACHINE—FRONT VIEW.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World.

CANADA'S TRADE INCREASED.

THE Customs revenue of the Dominion for the past calendar year has totalled $113,885,024, an increase of $4,453,918 as compared with 1912. The increase, however, is due to a good start in the early months of the year, before the financial depression had well set in, and before merchants and wholesalers had begun to restrict their importations of goods for the fall and winter trade.

During the past three or four months there has been a marked decrease in Customs revenue as compared with the corresponding months of last year. In November the decrease was $1,572,490. For the month just ended it has been $991,175. The total Customs revenue for December was $7,779,080, as compared with $8,770,255 for December, 1912.

A Net Decrease.

The fiscal year thus far now shows a net decrease of $1,017,253. Total Customs revenue for the nine months since April 1 last has been $84,278,786, as compared with $85,296,039 for the corresponding nine months of 1912. The increase in Customs revenue during 1912, as compared with 1911, was approximately $26,000,000. This year the increase has only been about one-sixth of that amount.

Trade Figures.

Trade figures for the full calendar year are not yet available, but for the twelve months ending with November last, the total was $1,132,670,000, as compared with $1,005,700,356 for the preceding twelve months. The total trade in merchandise, included in the former figure, was $1,108,413,015, made up of $665,196,828 imports and $419,073,050 exports of Canadian produce, and $24,143,137 exports of foreign produce. Imports of coin and bullion totalled $7,215,980, and exports $17,041,005.

As compared with the twelve months ending with November, 1912, there was an increase of $37,325,297 in imports of merchandise, and of $84,861,383 in exports of Canadian produce.

GEORGIAN BAY CANAL COMMISSION.

W. SANFORD EVANS, former Mayor of Winnipeg, it is learned, will head the Commission which the Government proposes to appoint to consider the economic feasibility of the Georgian Bay Canal proposition. The Commission, it is expected, will be officially named in a few days, and will consist of three members—one from the West, one from Montreal, and the other from Ontario. Huntley Drummond, of Montreal, has been favored by many as the Quebec representative, but a French-speaking man may be selected. Unofficially, ex-Mayor Laporte is spoken of. Save as regards the chairmanship, however, no decision has been arrived at.

It will be recalled that some years ago a complete survey for the projected work was made and the cost was estimated at $100,000,000. There has since been a revision of the estimate and the figure now is placed around $125,000,000.

The reports made so far established beyond question the practicability of the canal as an engineering work. What the Government now wishes is a report as to the economic side of the undertaking. Very naturally before embarking upon a transportation scheme of such magnitude it desires to know whether it would be a paying proposition and fulfil the object for which it has been sedulously propagated for half a century. The Commission to be appointed will have full inquisitorial powers.

Mr. Evans is a Winnipeg financial broker. He was born at Spencerville, Ont., in 1869, the son of Rev. Dr. J. S. Evans; was educated in Hamilton and at Victoria University, and in 1897 began a newspaper career. He was editor of the Winnipeg Telegram 1901-5, and Mayor of Winnipeg 1909-11. He was president of the first Canadian Club (Hamilton, Ont.) formed in Canada. He married Miss Irene Gurney, of Toronto, in 1900.

CANADA'S COAL OUTPUT IN 1912.

THE production of coal in Canada in 1912 exceeded that of any previous year, the total production being reported as 14,512,829 short tons valued at $36,019,044, and constituting nearly 27 per cent. of the total value of the mineral production of the Dominion during the year. Compared with 1911, in which year the production was 11,323,388 short tons valued at $26,467,646, an increase is shown of 3,189,441 tons, or 28 per cent. in quantity and $9,551,398, or 36 per cent. in total value.

The largest previous year's output was in 1910, when the production was 12,909,152 short tons, valued at $30,909,779, compared with which 1912 shows an increase of 1,603,677 tons or 12 per cent., and $5,109,265, or over 11.6 per cent. in total value.

In Nova Scotia there was an increased production in 1912 of 779,468 tons, or 11 per cent., over 1911. This province produced nearly 54 per cent. of the total in 1912, as against 62 per cent. in 1911. The production in New Brunswick is quite small in proportion to the other provinces, and amounted to only 44,780 tons in 1912, a decrease of nearly 20 per cent. from 1911. In the West for the first time on record, Alberta has the largest production, amounting to 3,240,577 tons, the production in British Columbia being 3,208,997 tons. The latter province would have had a higher production had labor troubles not prevented a normal output. The production in Alberta is the highest record for that province, while in British Columbia the greatest production was attained in 1910.

WESTERN DEVELOPMENT.

MEDICINE HAT'S building statistics show a forty per cent. increase during 1913, the figures being $3,851,572, as compared with $2,836,219 for 1912. Customs receipts increased 70 per cent. The figures are: 1913, $316,872; 1912, $184,758. Ten factories were erected at a total expenditure of $3,000,000, and homestead entries totalled 134 for December.

Statistics for the past year for Saskatoon show bank clearings, $96,034,723.27; Customs receipts, $1,087,510.70; building permits, $2,633,845.

Regina reports bank clearings for December, $13,356,411, and for the past year, $132,087,457, being an increase in clearings for the year of $16,357,806. Building permits for the year were $4,018,350; slightly less than the previous year. Over seven hundred new houses were erected.

Bank clearings of Calgary for the past year were $247,882,928, against $275,492,303 in 1912, which was Calgary's big year of development. Building permits were about $8,000,000.

REGULATIONS REGARDING SCALES.

THE weights and measures regulations of the Department of Inland Revenue have been amended to provide that no spring scale of the dead load

type or of the combined lever and spring-scale type, except such as are constructed on the correct knife-edge principle and approved by the Department shall be manufactured in or imported into Canada. Such scales must not be sold, offered for sale or kept in stock after sixty days from the date of the new order. Scales of the type described where now in use may continue to be used subject to departmental inspection.

Exceptions to the above prohibitions are made in regard to ice spring scales, sportsman's pocket spring balances up to 15 pounds, photographers' mixing scales up to 16 ounces, and the farmers' milk scale. Family or household scales hereafter must comply with the requirements of trade scales of their class. Manufacturers' and dealers' stocks of such scales may be inspected and stamped for a period of sixty days from the date of the new order.

Except in regard also to existing stocks, the new regulations provide that the weight graduations on beams and dials of all weighing machines shall be equal amongst themselves unless otherwise specially provided. New schedules of tolerations of error for various classes of scales and new regulations governing measures of capacity are published in technical detail.

Railway companies are required to provide a test car for the inspection of all track scales within six months. The Order-in-Council under which these changes are made provides also for a reduction in the fees charged for the inspection of scales inspected oftener than biennially. The present rate is two-thirds of the ordinary fee.

BUSINESS PARTNERSHIP INSURANCE.

By Sheridan Campbell.

THE public is waking up to the supreme importance of partnership or business insurance. The value of the individual life to a partnership or to a corporation is being more fully recognized, and, as a consequence, it is becoming a general practice among partners in every line of business to insure their lives for the benefit of the firm.

This insuring of partner's lives for the benefit of the business is only one of many ways in which a house may use life assurance to protect its interests. Many corporations, as well as partnerships, depend to a large degree upon the skill and ability of some employee whose knowledge, technical or practical, is of prime importance. Almost invariably, the affairs of a large corporation are directed chiefly, if not wholly, by a single individual, or at least by a limited number of individuals. The death of a manager may mean heavy financial loss, which ought to be covered by insurance, and the death of one member of a firm, in addition to the loss of his active co-operation in the management, may involve the withdrawal of his capital from the undertaking. This latter might mean infinite embarrassment to the remaining partner or partners, and perhaps the discontinuance of the business. If, however, his life is insured for the benefit of the firm, the proceeds of the policy would enable the remaining members to buy his interest and continue the business without hindrance or delay. Protection of the interests thus involved is accomplished usually by a separate policy on the lives of those upon whom the successful conduct of the business may depend, although this is sometimes met by a joint life policy covering all the lives it is desired to protect.

The death of a co-partner naturally awakens uneasiness among creditors, which may result in embarrassment to the firm. When it is known, however, that the deceased member's life was insured for the benefit of the firm, confidence instantly takes the place of doubt and hesitation.

Banks and wholesale houses well understand the difficulties that beset a business firm upon the death of a member, and this is a risk which is always considered in granting accommodation. No one feels the pulse of the business world on matters of credit better than the great commercial agencies. The late Charles F. Clark, President of the Bradstreet Company, a short time before his death, wrote a friend as follows:

"It is practically beyond a doubt that corporation insurance strengthens the credit of firms adopting it. The increased confidence which it establishes is recognized in the mercantile community, and thus reflected through our reports."

A Real Necessity.

No partnership or corporation would for a moment fail to insure its property or plant against fire, yet the death of a co-partner, or of a managing official may cause even more serious embarrassment than a destructive fire and, as a matter of fact, is more likely to occur. Every member of a firm, every manager of a corporation, is bound to die sooner or later, but a fire may never occur. Business insurance requires an expenditure of partnership or corporation funds, the same as fire insurance, but there is the difference that the business insurance policy is a growing asset and will be carried as such on the books of the company; the value increasing from year to year.

In these days when so many large corporations are borrowing from the public by issuing debentures or are asking the public to purchase preference stock, the protection of the interests and earning power of the corporation is a necessity that life insurance supplies. The preparation, for the retiring of a bond issue by a company at maturity, by the carrying of endowment insurance is another feature of the present day insurance propaganda.

Provision is made in the policies whereby, at the dissolution of a partnership, the retiring partner may continue his own policy on his own account if desirable, or a cash settlement may be had. The present day policies are so well designed, that almost every conceivable point has been safeguarded to the advantage of the insured.

Employees Accident Insurance.

Manufacturers, contractors, builders, lumber manufacturers, millers, etc., all find it to their advantage to carry protection against claims arising out of accidents to employees and others by the issuance of accident insurance. Commercial travellers, business men, doctors and men in all walks of life also avail themselves of the benefits of accident and health insurance, and what business house, bank or financial corporation does not place on some responsible employee a guarantee bond to indemnify themselves against loss through misuse of funds.

Farmers are in these days insuring their standing crops against weather; also their valuable animals, which all goes to show to what extent the principle of insurance is being adopted, and the variety of business interests affected.

If it be wisdom to protect one's property against "possibilities," how much wisdom is displayed when protecting against "certainty." There can be no doubt as to the wisdom of protecting one's family against the cutting off of the earning power of the home. The interests of the business world and the home are identical; the loss sustained by a business through the death of a partner, being immediately reflected back to the latter's family.

Business insurance secures the speedy adjustment of a deceased partner's interest, and admits of neither inconvenience to or cessation of operation.

NORTON GRINDING MACHINE.

(Continued from page 45.)

started unless the work is revolving. The act of stopping the table connects the hand wheel for moving the table by hand, and this hand wheel is disconnected when the table is started. The table is of new design in that the footstock covers the dovetail ways on which the footstock slides, protecting these ways from dirt and injury.

The steadyrests, designed especially for small work, are provided with micrometer stops, and are arranged for quick handling. The workshoes are of steel, hardened and ground.

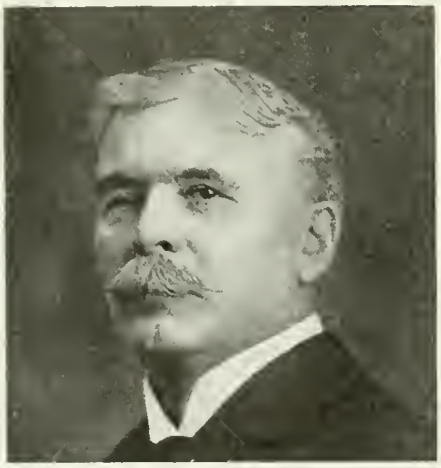
INDUSTRIAL NOTABILITIES--No. 16

THE plant of the Dominion Steel Corporation is in Sydney, N.S. The President, James Henry Plummer, resides and works in Toronto. Once in a while he puts on his hat and coat and runs over to Sydney for a look over the plant. Like a war in Afghanistan being directed from the War Office in London, the brain which controls the Steel Corporation's operations is away from the scene of actual production.

One remarkable thing about J. H. Plummer is his wonderful memory. If he is not at Sydney, Sydney is with him. He keeps the details in his head. If a certain task is to be performed in a year's time he will expect it done. In this regard he differs from the presidents of many other large corporations who concern themselves only with the big affairs. J. M. Plummer carries the details of the Sydney plant around with him.

He is an indefatigable worker, not only in his office, but at Sylvan Tower, Rosedale, his beautiful Toronto residence. Men who have been invited to his mansion tell of late hours spent in solving problems connected with this gigantic industry. Under the greatest provocation he never loses his temper. His coolness is characteristic.

J. H. Plummer was born near Tavistock, Devonshire, England, February 19, 1848. His father was the late William Plummer, Commissioner of Indian Lands in Canada. He received his education at Upper Canada College, and in 1866 he took his first earning position in the service of the Bank of Montreal. On the organization of the Canadian Bank of Commerce he joined their staff, becoming the manager at Barrie, Ont., in 1870.



JAMES HENRY PLUMMER.

In 1872 he was manager at Brantford. He held the same position at Ottawa in 1874, and became inspector of the bank in 1876. Mr. Plummer lived in Michigan from 1878 until 1882, and on his return to Canada, entered the service of the Merchants' Bank, taking the office of Assistant General Manager, and remaining with that bank until 1900, when he became associated with the Bank of Commerce. In 1903, he became President of the Dominion Iron and Steel Co., Ltd. Since 1910 he has been President of the Dominion Steel Corporation, Ltd.

He is President of the Dominion Coal and Steel Companies, Sydney and Louisburg Railway Co., and Cumberland Railway and Coal Co.; a director of the National Trust Co., of the Sao-Paulo Tramway Light & Power Co., and of the Bank of Nova Scotia; Vice-President of the Canada Life Assurance Co., and President of the Canada Lake Transportation Co.

Mr. Plummer was commodore of the Royal Canadian Yacht Club 1900-1901, and is a member of most of the leading clubs in Toronto and Montreal. He was married in 1871 to Annie McConkey, of Barrie, Ont., only daughter of the late Thomas D. McConkey for many years a member of the House of Commons. Most of his time is spent in Toronto, but in summer, he takes his two sons and three daughters to Sydney, where he has a home on King's Road. When not very busy he plays golf, but he is usually very busy.

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Vol. XI. JANUARY 8, 1914 No. 2

PRINCIPAL CONTENTS.

CANADIAN NATIONAL EXHIBITION MACHINERY HALL.

THE recording of a vote adverse to necessary additions and extensions projected in the present year at the Canadian National Exhibition, Toronto, is a regrettable happening, and again exemplifies the fate which befalls every effort made in the direction of real tangible and "worth while" domestic, social, scientific, civic and political progress, when some other and less important issue, but one in which personal spleen is rampant and spreads itself, makes men lose their heads. The pity of it all is that the big show held annually at Toronto in the early fall, and known over the North American Continent and abroad as the Canadian National Exhibition, should be at the mercy and whim of the constituents of any particular municipality.

Much attention was paid and substantial effort directed during the Exhibition of last year to have the total attendance pass the million mark, as if mere turnstile records constituted a successful result, and while we have no idea of depreciating the many departments of usefulness which contribute towards a united expression of the Dominion's development and progress, we do think that the section known as the Machinery Hall does not receive the high degree prominence which is its right, because of the place and part occupied and played by our arts, crafts and manufactures.

A large proportion of Canada's population are directly engaged in some more or less kin manufacturing industry to mechanical, electrical, steam and hydraulic engineering, and it goes-without-saying that a high percentage of the offspring of those now actively engaged in mechanical pursuits will follow this same trend. Machinery, perhaps, more than anything else, holds a fascination for the schoolboy growing into manhood, a circumstance amply borne out, we think, by the large and increasing numbers enrolling in the several engineering courses at our colleges and universities.

Engineering in its widest scope has contributed more to the development and commercial achievement of Canada than has any other feature, not excepting agriculture, for it has made the latter capable of attaining a prominence and value not otherwise possible. Exhibitions, such as we have in Toronto each year, are of high educative value in a variety of manner, and may be so even in their most frivolous features, but it must be remembered that out of say half a million adult or juvenile males who enter the gates in one short season, a large proportion are mechanics, or are engaged in mechanical pursuits, and to these the fuller education derivable will be that obtained from the study of a display of machinery in whose completed perfection they may be daily employed in the preparation of one or more detail parts.

We live in a day of specialization, as a consequence of which it is not given us to see or know much of what others are doing outside our own particular sphere. An exhibition diversified in its contents and representative in the scope of and provision for the sectional features which are indicative of the bent of our population, gives all, and it may be the only opportunity to acquire that general knowledge which for its own sake is valuable, but which furthermore is immeasurably helpful to our individual specialization.

At the recent elections in Toronto, an indifferent acquiescence was observable in that it would be advisable to support the by-law to provide funds for adding to and extending the scope and usefulness of our National Show, but, amid all the electioneering, in its multitudinous forms, not one of the prospective candidates and a similar quota of electors in the various wards had the gumption and backbone to step out from the arena of bandying personalities and impress the necessity of getting away from local petty jealousies, to allow of something being accomplished in a national sense.

The complacent view taken of the defeat of the by-law, that on account of the money stringency, it is just as well that the decision was adverse, is too silly to discuss, for if anywhere in Canada, or for that matter anywhere else in municipal civilization, money is spent in a happy-go-lucky fashion, it is in hair-brained schemes promoted and fostered by the Corporation of Toronto.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Mont'l.	Tor'to.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3....	20 00	21 50
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3.......	20 00	22 00
Clarence, No. 3........	20 50	21 00
Jarrow	.....	23 50
Glengarnock	......	26 00
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1........	19 40	18 35
Victoria, No. 2X	19 15	18 10
Victoria No. 2 Plain ..	18 90	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh.........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal......	2.10
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh.....	1.20
Steel hoops, Pittsburgh..........	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.20
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents..**
Steel bars	1.70
Structural shapes	1.80
Plates	1.80

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 65; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base..		$2 30
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOILER PLATES.

	Mont'l.	Tor'to.
Plates, ¼ in., 100 lbs...	$2 30	$2 20
Heads, per 100 lbs.......	2 55	2 55
Tank plates, 3-16 in......	2 60	2 50
Tubes, per 100 ft.. 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	9 00	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb off
Nuts, Hexagon, all sizes..	4½ per lb off
Fillister head	25 per cent.
Iron rivets	60, 10 p.c. off
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, bronze	70, 10, 7½, 10 p.c. off

Milled Products.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in...	75%
Finished Nuts over 1 in....	72%
Semi-Fin. Nuts up to 1 in..	72%
Semi-Fin. Nuts over 1 in...	72%
Studs....................	65%

Discounts, f.o.b., Montreal.

OLD MATERIAL.

Dealers' Buying Prices.	Mont'l.	Tor'to.
Copper, light	$10 00	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings..	9 00	9 00
No. 1 wrought iron.....	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	13 00	12 00
New brass clippings....	8 50	8 75
No. 1 brass turnings....	7 25	7 50
Heavy lead	3 75	4 00
Tea lead	3 00	3 00
Scrap zinc	3 00	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price, per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$. 32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	.....	.....	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect from April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in. ..	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Mont'l.	Tor'to.
Lake copper, carload...	$16 00	$16 50
Electrolytic copper	15 75	16 00
Casting copper	15 50	15 60
Spelter	5 25	5 25
Tin	38 50	41 00
Lead	5 00	5 25
Antimony	8 50	8 50
Aluminum	21 00	19 50

SHEETS.

	Mont'l.	Tor'to.
Sheets, black, No. 28	$2.75	$2.70
Canada plates, ordinary, 52 sheets	2.75	2.75
Canada plates, all bright	4.00	4.15
Apollo brand, 10¾ oz. (American)	4.30	4.20
Queen's Head, 28 B.W..G.	4.40	4.40
Fleur-de-Lis, 28 B.W.G.	4.20	4.25
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.40	4.40

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.26
Benzine, per gal.	23½
Pure turpentine	0.60
Linseed oil, raw	0.60
Linseed oil, boiled	0.63
Plaster of Paris, per bbl.	2.10
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b. Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Jan. 5, 1914.—The beginning of the new year sees most lines of business rather quiet, and it is unlikely that there will be any material improvement during the present month. Machinery brokers have had no opportunity for submitting any important tender since the middle of last month when quotations were put in for the G. T. P. equipment at Prince Rupert, B.C.

A number of factories reopened their doors to-day, after being closed down since December 31 for the New Year holidays, which are always carefully observed in this province. Some plants would doubtless have re-opened on Jan. 2 but for the scarcity of water following the recent breakdown of the intake conduit, reported last week. Repairs were effected by the early morning of Wednesday, December 31, but proved to be of such a flimsy character that they gave out after the pumps had been in operation only ten or fifteen minutes. The engineers on the job at once set to work to again effect repairs; but it was not until late in the evening of January 2 that the long-suffering public were once more able to obtain a normal supply from their taps.

Good progress is being made with the plant of the Canadian Vickers Co., Ltd., at Maisonneuve. A handsome office building is rapidly approaching completion, and the power house and the joiners' shop are nearly finished. The platers' shed will be the next building to be erected, and by the time navigation opens, the site will present a very different appearance from what it does now. It is understood that the mechanical equipment is being purchased in Great Britain.

Metals.

Copper shows a slightly firmer tendency, but the metal market generally is extremely dull. A leading dealer in old metals stated to-day that he had not sold a car of material for a month, and saw no immediate prospect of any improvement.

Tool steel salesmen also complain that they are unable to obtain anything but a few small orders.

Errors in Weighing Apparatus.

The issue of The Canada Gazette, dated January 3, 1914, contains eleven pages of amendments to the present weights and measures regulations, which are of great importance to makers and users of scales. One of the most important amendments is that which provides that after sixty days from date, no spring scale of the dead load type shall be manufactured in or imported into Canada, but that all such scales now in use may continue to be used, and be periodically inspected and stamped as required by law until found incorrect and incapable of being made correct without the renewal of some fundamental part of the mechanism.

Six exceptions to this regulation thereafter follow, dead load spring scales being permitted for the weighing of ice and certain other commodities.

Toronto, Ont., Jan. 6, 1914.—For some weeks manufacturers in Ontario have been waiting for the time when they could buy steel bars at $1.15 f.o.b., Pittsburg. The tendency on the part of the buyers has been to find the low market, and this very tendency is a symptom that the market will go lower, or that there is about to be a strengthening. While it is a buyers' market, nevertheless, the situation will be controlled by the manufacturer's conviction that he is selling as low as his costs will permit. Many feel that as soon as the buyer is convinced that the manufacturer is willing to rest upon his conviction, then buying will begin. Very few firms really need steel just now, though many would like to make contracts for next March, if they were only sure that the market would go no lower than 1.20. Steel makers are anxious to get business for their mills at once, but are not anxious to burden themselves with orders for June, say, at present prices, when business might be flourishing and prices much better.

Warehouse business remains about the same. Practically all interest centres in the mill end of the business. Inquiries are being made by all classes of manufacturer. It is likely that as soon as one begins the rest will follow.

While little business in steel bars is being done, the Dominion Steel Corporation, who do a big business in Ontario in wire and nails, report that the New Year has opened up remarkably well, and that if every day is as good as the first days of the year, 1914 will be a good year. Just now the retailer is getting ready to take stock, following the Christmas and New Year trade. He is not ready to buy, except special goods. Consequently, the jobber, who is still going over his inventory sheets, is not buying. So business in wire, nails, screws, bolts, and the like is slack.

Drummond McCall & Co. report that the New Year started off well. They believe that stock prices will be firmer now that the old year has gone.

There is practically nothing to say regarding machine tools. Little buying is going on. Specifications for tools required in their new Ottawa shops should be issued by the C. N. R. shortly.

The metal market is unchanged.

St. John, N.B., Jan. 3, 1914.—Tenders are soon to be called for the erection of the proposed plant of T. McAvity & Sons, Ltd., which will cover an area of twenty-two acres. The list of buildings to be erected includes a warehouse, two iron machine shops, two brass machine shops, two casting storage shops, malleable iron foundry, grey iron foundry, pattern shop and storage, core room, brass casting storage, brass foundry, power house, administration building, garage and stable.

About 175 men have been laid off by the J. S. Metcalf Co., who are building the new grain conveyors at West St. John. The lay-off was necessitated by the rapid construction progress. By

February the new conveyors will be completed and in operation.

A. V. Tracy-Gould, of the firm of T. Pringle & Sons, Ltd., of Montreal, has been in St. John with the intention of establishing a branch of that company here in view of the prospects of industrial development. The only branch at present is in Toronto, but another is to be opened in Calgary and one in Vancouver later on.

DOMINION STEEL CORPORATION.

THE year just closed has been in many respects the most satisfactory in the history of the Dominion Steel Corporation. Its collieries and steel works have been operated to their full capacity throughout the whole period, and the results are the best that have yet been obtained. Its army of 16,000 or 17,000 employees were kept constantly at work, and it is claimed that no similar body of men in Canada received as large an average daily wage.

The combined output of collieries in Cape Breton and Cumberland Counties will reach the unprecedented total of 5,100,000 tons, nearly 200,000 tons greater than the output of 1912, which in turn exceeded all previous records.

New Loading Pier.

The most important item in the way of improvement to the Coal Company equipment is the new loading pier at Sydney, a structure some 1,500 feet in length, fitted with the most modern appliances for rapid and satisfactory work. As an evidence of what this means it may be mentioned that a coal carrying freight steamer of 10,000 tons capacity can be fully loaded in about seven hours. In the month of June, shortly after its completion, H.M.S. "Cumberland" was moored at this pier and received 1,200 tons of bunker coal in 12 hours. To facilitate the work of coaling cargo steamers calling at Sydney for bunker supply a new conveyor has been constructed on the "Whitney" or No. 2 pier.

Large expenditures were made in completing the equipment of the newer collieries in the Waterford district, in the erection of workmen's houses and in preparation for the re-opening of the Victoria Mine.

Steel Works Active.

The Steel Works were equally active, and the extensions to the plant which had been in course of construction during the two or three previous years were brought into service. The most notable of these were the big open hearth furnaces, known respectively as A and B. These were put into commission in the first quarter of the year. Blast furnace No. 7 was "blown in" on May 22, and is regarded as the best of the six that now constitute the company's smelting plant.

On Saint Patrick's Day the merchant bar mill became a producer, and at the close of the year had turned out 16,000 tons of steel bars of all sizes, from 1/4-inch to 1 1/4-inch in diameter, as well as flats and other shapes. The major portion of this tonnage was specially made for reinforcing heavy concrete work, such as the foundations and walls of grain elevators, hydraulic works, etc. At Port au Port a new limestone quarry was opened and equipped with machinery for quarrying, crushing and preparing the stone for blast furnace use. A shipping pier was built, and conveyors installed with sufficient capacity to load a 10,000-ton steamship in a few hours. Shipments were made from the new works as well as from Marble Mountain during the season of navigation.

Among the minor improvements to the Sydney works may be mentioned a powerful travelling gantry crane for use of the blast furnace department, a third open hearth charging machine, and a furnace for reheating steel ingots in connection with the blooming mill.

Works Capacity.

In the past two years the Steel Company's works have not only been greatly enlarged, but they have also been made capable of producing a greater variety of materials. Before the completion of the wire and nail mills, completed in 1912, and the merchant bar mill, referred to above, the output of the works was confined to rails, wire rods and such moderate quantities of pig iron and steel blooms as could be spared after the requirements of the rail and rod mills were provided.

It is now possible to market in addition as many rails as ever, a large tonnage of pig iron, wire and wire nails of all kinds—plain and galvanized—fencing, staples, square, round and flat steel bars—straightened or twisted if required—as well as blooms for car axles and billets for use in the smaller rolling mills throughout the country which do not produce their own raw material. The possible output has been not only greatly increased, but it has become more varied and in consequence more flexible. In other words, the company is in a better position to adapt its output to the requirements of the market.

Year's Results.

The following figures will closely approximate the actual results for the year:

Department.	Tons.
Coal mines	5,100,000
Iron ore mines	780,000
Limestone quarried	582,000
Pig iron produced	357,000
Steel ingots produced	347,000
Rails	175,000
Blooms sold	32,000
Wire rods made	32,000
Wire and wire products	24,000
Steel bars, etc.	16,000
Sulphate of ammonia	5,000
Basic and granulated slag	25,000
Tar (gallons)	5,650,000

Outlook Encouraging.

The outlook, though not as certainly assuring for the coming year as it was at the end of 1912, it still quite encouraging. Orders upon the books are sufficient to ensure active work for some months to come, while enquiries indicate that there will be no serious abatement in the country's requirements of the basic products of these great works, and there is always the possibility of disposing of surplus tonnage to the sister Dominions across the seas.

The steamers of the New Zealand Shipping Company have made regular calls at Sydney for some months, and have taken moderate quantities of steel products as well as bunker coal. These calls will be continued during the winter unless ice conditions are unfavorable, in which case the ships will go to Louisburg. Australia, which some years ago took a large quantity of Sydney rails, has lately given an order for a fair-sized lot, and the indications are that when the mills are ready to start up after a rest of ten days for necessary repairs and setting up there will be work enough in sight to keep them running full time.

CANADIAN MARINE WIRELESS RULES.

NEW wireless regulations governing navigation throughout the Dominion came into force on January 1, when all provisions of the Act governing Canadian wireless passed last session by Parliament became effective. Roughly speaking, the result of the new regulations is that no vessel carrying 50 or more passengers or going 200 miles or more may hereafter be without wireless apparatus. Winter navigation on both coasts of Canada will feel the effect of the regulations immediately, but it is understood that most vessels engaged in ocean traffic are already equipped with wireless as required.

The main changes necessitated by the Act will be in lake vessels, but this will not be until the resumption of navigation next spring.

J. J. Carrick, M.P., Port Arthur, has returned from England, but will say nothing about the steel plant which he and the Mackenzie-Mann people contemplate erecting.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Sydney, N.S.—The Sydney Foundry and Machine Works, Ltd., have planned a number of extensions for 1914.

Waterloo, Ont.—Bechtels Limited, makers of clay working machinery, dump carts, etc., advise that they are not being offered inducements to move their plant.

Coaticooke, Que.—The A. O. Norton Co., makers of lifting jacks, are rushing the erection of a new shop on Cutting Street, in which work for all their men employed in the plant burned last week will be found.

Sydney, N.S.—Shaw and Mason, stove and brass founders, are planning large extensions for 1914, and though no definite scheme has been decided upon, it is expected that when the spring opens up, important announcements will be made.

Saskatoon, Sask.—Two iron claims consisting of 50 acres each, were staked recently at Yorkton, Sask., by W. Dell, a prospector of Port Arthur. Surface mining by means of steam shovels is proposed. The claims are six miles north of Kamsack, Sask.

Electrical

Paisley, Ont.—The new council will deal with the extension of the waterworks, and the electric lighting system will be discussed, as the power is not equal to the number of lights being used.

Winnipeg, Man.—The Kildonan council have applied to the city of Winnipeg for the lighting of Main St., from the limits of the city to the municipality.

Shoal Lake, Man.—The ratepayers have passed a by-law authorizing an expenditure of $15,000 for the installation of an electric light plant.

Cobalt, Ont.—The Don Huronia Mine, near Larder Lake will be closed in order to develop a water power which will enable them to operate the mine and the mill on a large scale.

Toronto, Ont.—Among the municipalities which voted for Hydro-Electric power this week were, Wallaceburg, Hanover, Fergus, Elora, Strathroy, Tilbury and Chatham.

Sydney, N.S.—The Broughton Coal & Iron Co., Broughton, N.S., are considering an electric plant capable of taking care of 2,000 tons of coal per day, the central power plant to be located at Broughton.

Hamilton, Ont.—The Dominion Power & Transmission Co. have prepared plans for their steam auxiliary plant, which will occupy 14 acres east of the National Steel Car. Co. plant. The main building will be 380 x 170 ft. by 50 ft. high. The transformer house will be 75x250 ft. Two units will be installed this fall, of 13,400 h.p. capacity. A unit will be added each year until the capacity is 88,000 h.p. W. C. Hawkins, managing director.

Municipal

Galt, Ont.—The city will spend $15,000 on its waterworks.

Woodstock, Ont. — Embro village wants Hydro-Electric power.

Guelph, Ont.—The city will spend $17,000 on two new street cars and a new feed wire.

Brantford, Ont.—Preparations are being made to connect the gas pipes with the old purification plant.

Hamilton, Ont.—A by-law providing $335,000 for extensions to the Hydro-Electric system was passed on Jan. 1.

Nelson, B.C.—The ratepayers have voted in favor of purchasing the street railway. The city recently took over the gas works.

Toronto, Ont.—The ratepayers on January 1 voted in favor of the city acquiring a portion of Toronto and York Railway.

London, Ont.—The by-law to loan $25,000 to the Grobb Mfg. Co., who will take over the London Foundry, did not pass at the municipal election on Jan. 1.

St. Vital, Man.—Third readings have been given two by-laws to provide $200,000 for water and sewer extensions, and to provide $35,000 for the new fire hall.

Athabasca Landing, Alta.—On Jan. 12 the ratepayers will vote on a by-law providing $85,000 for completing and extending the present waterworks system.

London, Ont.—The Greene-Swift Co. have been given a franchise to lay steam pipes across Carling Street to heat the north half of Dundas Street, from Talbot to Richmond.

Davidson, Sask.—The ratepayers have voted in favor of spending $8,500 on an electric light plant, which is to be purchased from the Canada Gas Produce Co., Barrie, Ont.

Chatham, Ont.—The city is contemplating giving $410,000 for the Chatham Gas Co.'s gas and electric plants. It will be necessary to spend $50,000 to make the electric plant serviceable for the distribution of Niagara power.

Berlin, Ont.—Four rural districts of North Waterloo are preparing to take Hydro power. Their names and rates for 50 h.p. are as follows:—St. Jacob's, $29.08; Conestogo, $36.59; St. Clement's, $42.68; Floradale, 40 horse-power, $51.57.

General Industrial

Port Lambton, Ont.—Part of the machinery for the American Drainage Co. Canadian factory has arrived. The home plant is at Dubuque, Iowa.

St. John's Nfld.—The Royal Biscuit Co., Ltd., has been organized, and will erect a factory here. George Neal, president, Robert Freeman, secretary.

Quebec, Que.—Tourigny & Marois, shoe manufacturers, whose plant was destroyed by fire recently, have secured a new site, and have been granted an exemption of taxes for five years.

Iona, N.B.—The construction of a $50,000 calcining plant for the Iona Gypsum Co. is to be commenced at once, about 1½ miles from Iona Station on the shores of the Bras d'Or Lakes.

Elmwood, Man.—Fire did damage amounting to $25,000 to machinery, stock, etc., and $6,000 to the building of the Winnipeg Tanning Co., Ltd., Elmwood, last week. The loss is covered.

Bow Island, Alta.—W. Overpack, Medicine Hat, has organized the Bow Island Sewer Pipe and Tile Co., who will build a plant here on a 60-acre site. The plant must be operating by Jan. 1, 1915.

Calgary, Alta.—The Royal Linen Mills, Mystic, Conn., will erect a plant here to employ 100 persons, to manufacture all kinds of linen fabric, linoleum, etc. There will also be a flax mill and a linseed oil mill.

Wood Working

Burford, Ont.—A Brantford man is arranging to build a planing mill here.

Strathroy, Ont.—The Handles factory, employing 50 men, was burned on Jan. 5 with loss of $30,000; insured. J. W. Cameron is president of the company operating the mill.

Strathroy, Ont.—The factory of the Canadian Handle Merger was destroyed by fire at a loss of $100,000 on January 5. The new plant will probably be built elsewhere. W. H. Braddon, London, Ont., general manager.

Chicoutimi, Que. — The Chicoutimi Broom factory, in the village of Riviere du Moulin, near here, was completely destroyed by fire last week. The loss will amount to several thousands of dollars. Messrs. Grenon were the proprietors.

Contracts Awarded

Sherbrooke, Que.—MacKinnon, Holmes Co., Ltd., have secured the contract to build a steel bridge at Nicolet Falls, Que.

Winnipeg, Man.—The Board of Control will instal a duplex steam booster pump at the new King George hospital, and have awarded the contract to Cotter Bros. for $550.

Victoria, B.C.—The C.P.R. have awarded the contract for lengthening the coastal steamer Princess Mary, to the British Columbia Marine Railway Co., Esquimault, B.C., work to commence early in January. An oil fuel system will also be installed.

Winnipeg, Man.—A contract has been awarded by the city to the Dominion Equipment Supply Co., representing the Dean Steam Pump Co., of Holyoke, Mass., for the supply of two new deep well pumps, with a guaranteed capacity of 600,000 gallons per day, costing $7,200 each, and guaranteed to be in operation by April 1.

New Incorporations

Kalmus, Comstock and Westcott, Inc., incorporated at Toronto, capital $40,000, to engage in and carry on scientific research, to invent, and produce machines, etc. Herbert T. Kalmus, Kingston, Ont., the company's attorney.

Pilkington Bros., Ltd., incorporated at Toronto, to carry on business as manufacturers of and merchants dealing in plate, sheet and all other kinds of articles of glass.

Two Miles Falls Water Power Co. has been incorporated at Quebec to develop water falls and to transmit power. Headquarters at Sherbrooke, Que. Incorporators: Israel Louis Lafleur, merchant, Montreal; J. E. Roberge, Lambton, Que., etc.

The Pas, Man.—Tenders addressed to H. H. Elliott, M.D., Secretary-Treasurer of the town of The Pas, will be received up to February 3rd, for the construction of the following work:—Construction of approximately 430 feet of 16 inch supply intake main and two sewer outlets into the Saskatchewan river. Murphy & Underwood, Consulting Engineers, Saskatoon, Sask.

Northern Canada Supply Co., Ltd., incorporated at Toronto, capital $200,000, to engage in the business of jobbers, wholesalers, manufacturers and dealers in heavy and shelf hardware, railroad, street railway, steamboat manufacturers, mill, factory, foundry, forge, shop, machine shop, electrical, builders', plumbers', miners', steamfitters', gas-fitters', and other supplies; tools, cutlery, saddlery and saddlers' goods, round and bar iron, bar and tool steel; vehicles, coal, machines and machinery, powder; to operate foundries, machine shops, repair shops, for the construction and repair of articles mentioned above, at Cobalt, Ont. Incorporators: Charles J. F. Collier, Arthur B. Mortimer, etc., Toronto.

Marine

Sarnia, Ont.—Dominion Government surveyors are at work on the proposed harbor for this town.

Dump Scows Launched.—M. Beatty & Sons, Welland, Ont., recently launched two steel dump scows, 156 ft. x 36 ft. x 14 ft., each of 800 cubic yards capacity.

Vancouver, B.C.—A. F. Yarrow, head of the Clyde shipbuilding firm bearing his name, announces that he has bought out the British Columbia Marine Railway Co., and intends to establish a branch of his yards at Esquimalt, B.C.

Levis, Que.—The shipbuilding firm of George T. Davie & Sons has been acquired by George D. Davie, who will form a new Company, to be known as the Davie Company, Ltd. The Davie firm for years have been closely identified with shipbuilding and salvage interests, and operated the Levis graving dock. George D. Davie will, in all probability, be the President of the new concern, which will be capitalized at $1,000,000.

Ship Assessment.—Rules prescribing the method of measurement for the basis of assessing tolls on ships in the Panama Canada were issued on November 21 in a proclamation signed by President Wilson. They strictly define the cargo capacity of various types of shipping, and in general are framed on the same lines as the rules of the Suez Canal. In some respects they are more stringent than the Suez rules, but in others are more liberal. The rules do not affect the $1.25 per ton rate previously prescribed in a Presidential proclamation.

Dipper Dredge Order.—M. Beatty & Sons, Welland, Ont., have just closed contract for a steel dipper dredge with hull 100 ft. long, 40 ft. beam, and 10 ft. deep; delivery to be made by May 1, 1914. The dredge is of the crane type, with dipper handle and spuds of sufficient length to make 40 ft. of water. The dipper itself is of five yards capacity. This dredge is to the order of the C. S. Boone Dredging and Construction Co. of Toronto, and they will use it on one of the several large harbor improvement works recently secured. This five-yard dredge is similar to the dredges previously furnished by Beatty & Sons for the Canadian Dredging Co., Midland, Ont.; W. E. Phin, Hamilton, Ont.; the Dominion Dredging Co., Quebec, and others.

Tenders

Hamilton, Ont.—The city has received estimates on the erection of a new incline railway at Sherman Ave:—Excavation, $7,200; concrete, $27,000; 50 feet steel span with concrete deck, $25,000; buildings required, offices, etc., $35,000; buildings at top for motors, engines, etc., $55,000; changing sewer, $1,800; paving approaches, $2,800; water connections, $300; concrete piers, pedestal for steel incline, $4,600; steel incline in place, $32,600; two cars 50 feet long, elevating machinery, motors, engines, cables, safety cables, rails, gates, drums, etc., complete, $130,000; wiring for light and telephone, $500; contingencies, $6,400; total, $247,200.

Railways—Bridges

St. Catharines, Ont.—Announcement is made that a by-law will shortly be submitted to St. Catharines ratepayers providing for a bonus of $100,000 to the Canadian Northern Railway Co. in extending its line through this city.

Take Time to Read Your Paper

¶ Occasionally we meet a man who says "Oh, I haven't time to read trade papers! I'm too busy."

¶ He is typical of his class, and his class is growing smaller every year. He belongs to the betwixt and between variety, neither very large nor very small. His business is large enough to keep him at detail yet not big enough to permit of his hiring help to relieve him of petty duties.

¶ We refer to the owner or manager of a business which is just at the stage when it needs all the help and brains that can be given it. If the ideas that are constantly being supplied in "Canadian Machinery" were applied to the small but growing machine shop and manufacturing business, as well as to the large and well-organized industry, results would be amazing.

¶ Reading a trade paper, if a good one, should be one of a business man's first duties. Let him discharge that and the other claims upon his time will grow fewer in number and greater in importance.

¶ One of the most successful of the young men we know looks through "Canadian Machinery" from cover to cover every week. He glances through the editorial section, selects any article that may be applicable to his business, reads the Industrial and Construction News, Markets and special features. Then he starts at the front and reads the advertisements.

¶ His business is well organized, and everything moves like clockwork. He always has time to listen to a good proposition and he is a consistent and liberal advertiser himself.

¶ Take a half-hitch in your time for a few weeks and read your paper thoroughly if you haven't been doing so. It will only take you a few minutes each day, and results will be surprising.

¶ Fall into line with the big body of successful men who are keeping in close touch with changing conditions, improved methods, and new machinery.

Cornwall, Ont.—The promoters of the projected Glengarry and Stormount Railway, from St. Polycarpe Junction to Cornwall, are expecting to have their subsidy voted during the approaching session at Ottawa, and will consequently begin construction as soon as the frost is out of the ground the coming spring. The line runs through St. Telesphore Bridge End, Glen Donald, Glen Roy and Williamstown to Cornwall.

Smithers, B.C.—The proposed bridge across the Bulkley River at Smithers has been authorized by the Department of Works. Construction will start immediately. The approved plan calls for a four-span, Howe truss bridge, with a length of 500 feet. The new structure will be ready for traffic early in the spring. It will be of great benefit to many ranchers across the Bulkley, where there is a large number of farms under development. The bridge will afford direct access to the railway by the shortest possible route, and will mean much to the progressive agriculturists across the river.

Refrigeration

Vancouver, B.C. — The Vancouver-Prince Rupert Meat Co., 125 Hastings St. W., will erect a cold storage warehouse.

Trade Gossip

The C. P. R. Angus Shops at Montreal were closed down for over a week owing to the inability of the city to provide water.

The Donnaconna Paper Co., Quebec, will be closed down for five weeks to allow its main conduit being repaired. This will cost $15,000.

The Canada Foundry Co. last week paid off all its employees at the Davenport works. The reason given was the reorganization of the entire plant.

The Canadian Borden Co., Toronto, manufacturers of "Beaver" and "Premier" die stocks are distributing a useful souvenir knife among their customers.

The New Machinery Hall at the Canadian National Exhibition, Toronto, for which plans had been prepared, will not be built meantime, the ratepayers having voted against the expenditure.

Green & Sloan, Breadalbane Street, Toronto, have recently started up a welding and cutting establishment. Mr. Green was formerly foreman of the welding department of the Siche Gas Co., Toronto.

Eastern Car Company.—For the week ending December 20, all former records were broken at the plant of the Eastern Car Co., when they turned out 175 cars within the week. Up to date something like 840 cars have been turned out.

A. O. Norton, Ltd., makers of lifting jacks, whose plant at Coaticook, Que., was partly destroyed by fire last week, had only just completed details in connection with the organization of the new company. The capital stock is $250,000.

Shaw and Mason, stove and brass founders, Sydney, N.S., marked their 1913 progress with the erection of a three-storey 100x30 warehouse, and the reorganization of their works generally. During the year they took over the good will and plant of the Scotia Stove Foundry, of Halifax, and have incorporated the patterns of this Company's best lines in their manufacturing list. The foundry was considerably extended.

The John Bertram & Sons Co., Ltd., Dundas, Ont., have introduced a series of handy photograph cases for their salesmen. Each case is got up on the loose leaf style with leather covers and contains photographs of machine tools designed for special classes of work such as railway shops, general machine shops and structural steel plants. Each case is arranged so that it contains photographs of only those tools suitable for the one class of work.

The B. F. Sturtevant Co., of Canada, Ltd., Galt, Ont., recently sold an 8 ft. steel plate fan with engine and heater to the Toronto Street Ry.; heating and ventilating equipment for Pantages Theatre, Victoria, B. C., six large multivane type, motor driven fans with air washers and heaters for the Hudson Bay Building, Vancouver; a motor driven exhauster to the Jenckes Machine Co., Sherbrooke, P.Q.; heating and ventilating equipment for the Drummond Building and the St. Jean l'Evangeliste School, Montreal, P.Q.

"Safety First" Pays.—Eugene Lortie, Montreal, worked in the factory of Jean Baptiste Aubry. He drew the attention of the management to a defect in a machine. No action was taken. Later the employee lost three fingers. He demanded a lump indemnity, and a life pension. Usually, under the Workmen's Compensation Act of Quebec, the victim can only secure one of these sums, but in this case the employer had been guilty of inexcusable fault, and was ordered to pay both the lump indemnity and the pension. The repairs to the machine would have taken only a few minutes.

Information for Inventors.—Pigeon, Pigeon & Davis, patent solicitors, Montreal, report that 153 Canadian patents are issued for the week ending December 16th, 1913, 100 of which were granted to Americans, 32 to Canadians, 11 to residents of Great Britain and Colonies, and 10 to residents of foreign countries. Of the Canadians who received patents, 15 were residents of Ontario, 6 of British Columbia, 6 of Quebec, 3 of Saskatchewan, and 2 of New Brunswick. In the United States for the same week, 653 patents were issued, 11 of which went to Canadian inventors.

Estevan Lignite.—R. M. Blackburn, chief inspector of boilers for Saskatchewan, will leave shortly to conduct experiments with Estevan lignite coal at the plant of the Dominion Coal Co., Sydney, N.S. He will be accompanied by S. N. Darling, who is in charge of the Government experimental plant at Estevan, and the tests will probably cover the better part of two weeks. Three weeks ago, two carloads of carbonized screenings from the Estevan mines were shipped to the East, and this fuel is to be used in determining the efficiency of the fuel in a special type of furnace, only two of which are in operation in this country, and both at Cape Breton.

The Frost Wire Fence Co., Ltd., Hamilton, have adopted a profit-sharing policy, in which their wage-earners participate. Out of their year's earnings a sum has been set aside for payment to their factory employees in preferred stock, in proportion to their years of continuous service, for one year and longer. One share of preferred stock has been allotted to each workman, towards the payment of which a credit of ten dollars has been allowed for every year up to five and over, total credit not to exceed $50. In succeeding years it is expected that a further credit of ten dollars each year will be given, and employees have the privilege of applying sums towards payment.

Personal

James Steele, president of the James Steele Wire Works, Ltd., Guelph, died at his home, December 30.

R. B. Angus, C.P.R. Director, etc., Montreal, has started on a world tour to occupy several months. He is 82 years of age.

W. F. Vilas, M.P.P. for Brome, Que., and proprietor of the Vilas Implement Works at Cowansville, Que., is very ill at his home.

A. R. Woolridge, manager of the scale department of the Canadian Fairbanks-Morse Co., Toronto, has gone to his home in Texas for a month's holiday.

Round Houses on the National Transcontinental Railway

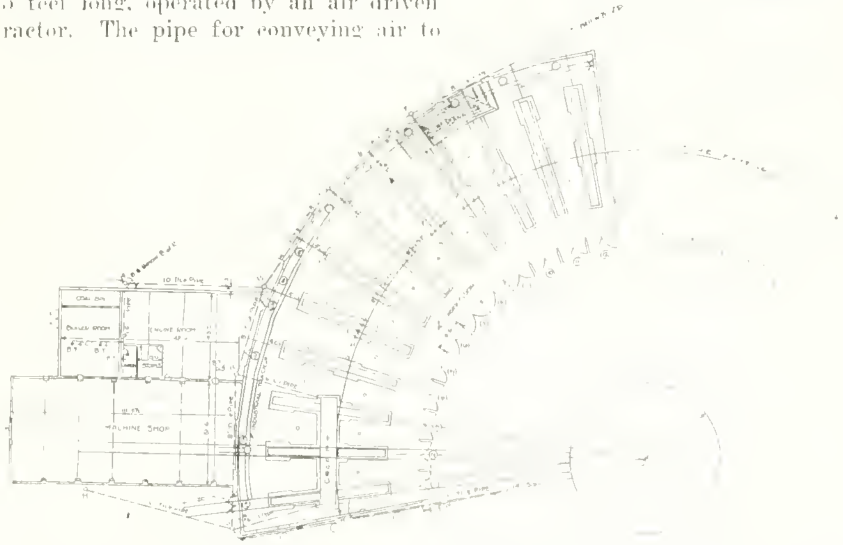
By C.T.R.

There is here given an interesting and highly instructive account of a needful accessory of any railroad worthy the name, but more particularly so of those which stretch from the shores of the Atlantic to the Pacific in this Dominion. To those unacquainted with round houses and their equipment, and the work performed in keeping our locomotives always fit, the article furnishes valuable data, and gives a clear insight into the reason why we in Canada, with a varying temperature on a 3,000 miles ride have maintained for us so efficient and reliable a railroad service.

WHEN the National Transcontinental Railway comes to be opened, a traveler from Moncton, N.B. to Winnipeg, Man., may be surprised to hear that his train was pulled over the various divisions of the line by a total of fifteen engines. This means that counting in the two terminals, there are sixteen round houses each supplying a locomotive to any continuously run west-bound train, with, of course, the same for east-bound traffic. The distance between Moncton and Winnipeg is 1,800 miles, and the round houses are spaced so that a fair average of 120 miles may be said to be about the distance between each.

Starting them from the east, they are Moncton, Napadogan, Edmundston, Monk, "Bridge," (i.e., near Quebec), Fitzpatrick, Parent, Doucet, O'Brien, Cochrane, (named after the Minister of Railways), Hearst, Grant, (named after the Chief Engineer of the Commission), Armstrong, Graham, (named after the former Minister of Railways) Redditt and Transcona, (near Winnipeg.) The latter name is, of course, an abbreviation of the word "Transcontinental."

Without counting the "Leonard" shops at Quebec or the Transcona large repair plant, there are six round houses with machine shops attached. Each round house has 12 stalls and each is equipped with all necessary appliances, such as boilers, feed and washout pumps, air compressor, electric generator for lighting, heating apparatus, and a well-planned drainage and sewer system. Each round house has a turn-table about 75 feet long, operated by an air driven tractor. The pipe for conveying air to the turn-table tractor is carried to the turn-table pit, and is brought up at the centre of the turn-table. The pipe is fitted with a ball and socket connection which enables the table to be swung round by the tractor. The old-fashioned time-consuming hand labor is dispensed with, by the use of this satisfactory and efficient appliance.

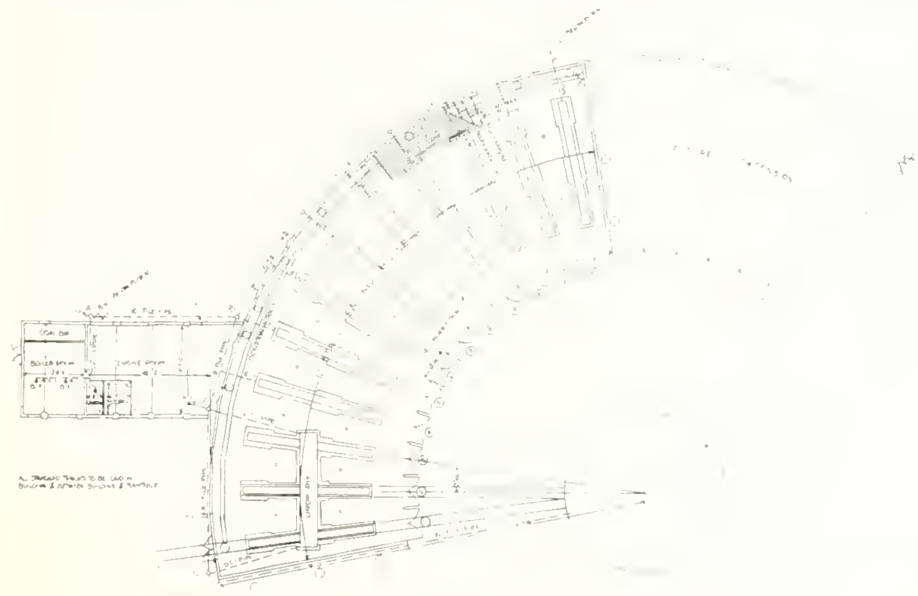


N. T. R. 12-STALL STANDARD ENGINE HOUSE WITH MACHINE SHOP.

Round House Equipment.

The equipment of the round houses with machine shops is adequate to the work to be done, and taking Grant, Ont., as a typical case, it consists of one 28 x 16 in. gap lathe; one portable 14 in. bolt lathe; one 20 in. vertical drill; one 16 in. crank shaper; one pipe machine 1 in. to 4 in.; one single bolt cutter ½ in. to 2 in.; one 6 in. x 36 in. grindstone; one double emery grinder with 16 in. wheels; one circular forge; one forge blower; and one anvil. This is practically the equipment for the machine shops; although perhaps slightly modified here and there by the substitution of one machine for another as circumstances directed.

These machine shop round houses are so placed as to be in the centre of an east and west operated division. In this way no locomotive is ever more than the length of one division away from a machine shop. Efficient repair work can thus be done economically, and without necessitating long mileage under reduced load, due to deterioration of power after long service; or in case of break-down, the light mileage is reduced to a minimum.



N. T. R. 12-STALL STANDARD ENGINE HOUSE WITHOUT MACHINE SHOP.

All the round houses are equipped with drop pits of modern design, and all are, in addition to their supply of compressed air, provided with hot and

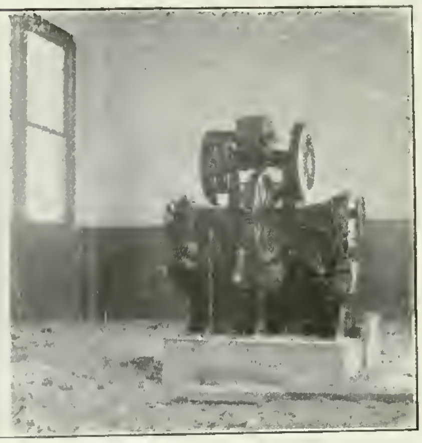
cold water. The pipes are run overhead, and are brought down the side of some convenient post where readily made connections enable workmen to repair the engines, and the boilers may be washed out, filled or otherwise "got ready" for the road. The round houses are lighted by electricity; convenient drop and portable lamps are also provided. The machine shop round houses are electrically equipped for driving the machinery, so that all kinds of work can be done with great facility and economy.

N. T. R. ENGINE HOUSE AT COCHRANE.
GENERATOR AND SWITCHBOARD AT COCHRANE. 4" DRILL, JIB CRANE, AND 80" WHEEL LATHE.

Heating Provision.

The engines are headed in to the round houses, and the smoke jacks are at the lower ends of the roof. Ample space in front and at the sides of the engines is thus secured. The heating of all the round houses is by hot air. Pure air from the outside is made to pass over coils heated by exhaust steam from the air compressor and the electric generator engines. When necessary direct steam from the boiler can be made to supplement the heat derived from the exhaust, so that by the operation of a large fan, a constant stream of hot air is circulated in the round houses. The hot air ducts discharge into the pits through three openings on each side, so arranged that the engine-truck and the "machinery" of the locomotive receive heat close to where they are placed on the pit. These are the parts which give most trouble in the winter by freezing. The third duct discharges in the vicinity of where the tender stands.

In this way an engine clogged with snow and ice and with the "motion" frozen up, is very quickly thawed out while standing on the pit, and in case of necessity or emergency, and in order to save time on an engine required for service soon after its arrival, the tank can be filled from the shop water service while it is standing on the pit, thawing out.

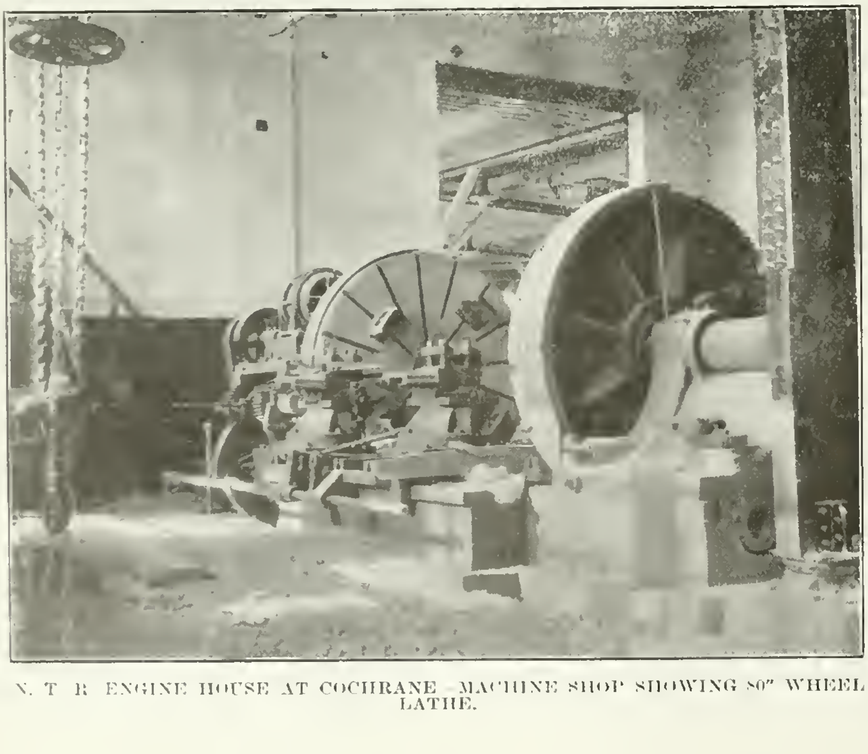


N. T. R. ENGINE HOUSE AT COCHRANE.
POWER HAMMER. PUNCH AND SHEAR.

A Waiting Track.

A very noticeable and unique point connected with the round houses recently constructed by the N. T. Ry. is the track which passes right through the round house, from back to front, along one of the walls. To this track there is an entrance from the turntable in the usual way. The track lies beside the drop pit, and a door is provided in the back wall. This arrangement permits a disabled engine to stand outside, until the round house staff is ready to receive it, and while so standing the engine does not block any track nor interfere in any way with the ordinary operations involved in handling engines. When required, and if a shunting engine is not available, the disabled engine can be "pinched" inside the shop, and work proceeded with at the convenience of the mechanical department, without delay and without having to depend on outside assistance, which may be hard to get at certain times.

This arrangement is most useful from an operating point of view, as it deals with railway work, not as it theoreti-



N. T. R. ENGINE HOUSE AT COCHRANE—MACHINE SHOP SHOWING 80" WHEEL LATHE.

cally should be, but as it actually is. The appreciation of this point speaks well for the forethought and the accurate, practical knowledge of things as they are, and of the contingencies which constantly arise in the daily work of a busy round house.

Round House Doors.

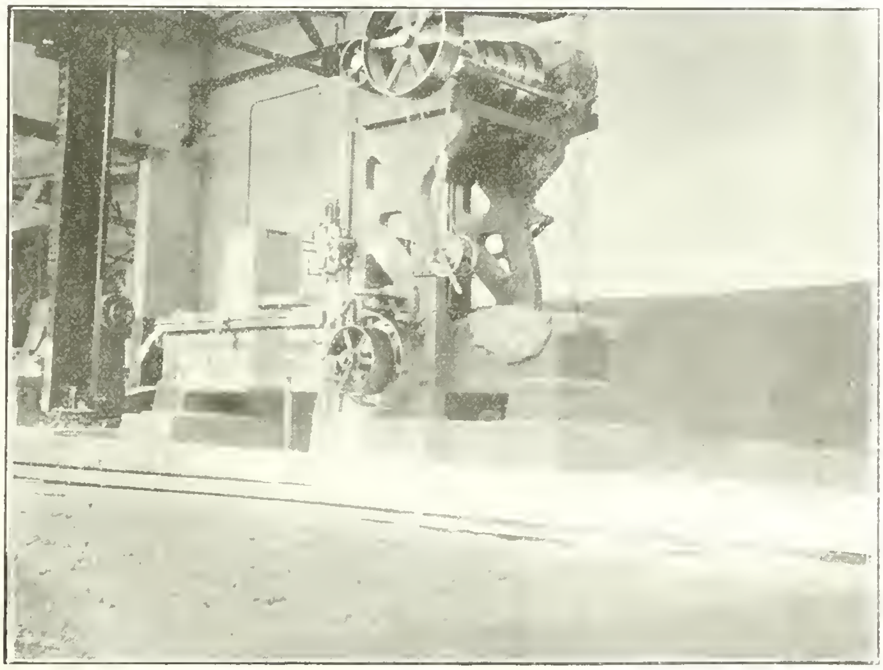
Another feature that has been carefully worked out is the round house doors. These are substantially made and well braced, so that the almost universal tendency of the doors to sag at the point has been practically eliminated. The doors fasten easily and firmly inside at the middle and at the bottom in the usual way, but the top has also been provided for. The tendency of all round house doors is to warp and gape open at the top, and, when this occurs, it is difficult to close them properly. A great amount of heat necessarily escapes uselessly, and the condensation and the drip thus caused usually freezes in a small but troublesome hillock of ice on the track. This ice must be removed before the doors can be opened. In order to prevent this delay, the top of the doors are locked by a bell crank, shod with a small wheel which, acting on a suitable bevel plate, draws the doors tight shut at the top, and holds them there.

The constant fastening of the doors, top, middle and bottom, reduces the tendency to gape and ensures a really tight-closed door every time it is drawn up. The gaping of a door even a few inches, may not, in an individual case, cause much loss of heat, but when it is remembered that each round house has many doors; that there are many round houses on the road, and that during the whole winter, several doors are bound to gape in each round house, the aggregate amount of lost heat becomes very great. It is cumulative effects of these small losses both in waste heat and the time expended in chopping ice at the doors, which brings this simple device up to the level of a necessary, practical and efficient piece of round house design.

The Directing Minds.

The work of construction of these round houses and small machine shops, and the many and important other practical matters connected with the building of the road as a whole, has been done under the careful and efficient supervision of Mr. Gordon Grant, the Chief Engineer. The practical, and one may almost say, the many operating details as well as the layout, design and equipment of the round houses and the machine shops attached, has been done by Mr. W. J. Press, the mechanical engineer of the Commission, who also designed, built and equipped the large shops at Transcona and is handling the "Leonard" shops at Quebec in the same efficient manner. It is to his intimate knowledge of the needs of the operating staff, working in all weathers, under varying conditions, and amid contingencies which daily arise on a railway, that the many economical features to be seen in the shops must be attributed.

Major R. W. Leonard, Chairman of the National Transcontinental Railway Commission has not only carefully examined the designs of all the shops, round houses and repair plants and the other details of road construction, but has carefully scrutinized the cost of installation and has weighed the reasons for the adoption of the various arrangements which, now that the railway is approaching completion, make it evident that the government have provided a thoroughly up-to-date railway line; and the people of Canada will have every reason to feel satisfied with the quality of the work done, and the intelligent provision for the future needs of the railway which is intended to serve a rapidly growing population in regions which would long have remained unproductive had it not been for the conception and the steady and efficient construction of the National Transcontinental Railway.



N. T. R. ENGINE HOUSE AT COCHRANE — MACHINE SHOP SHOWING 30" PLANER AND BOTTOM OF JIB CRANE

FAMILIARITY BREEDS CONTEMPT.

AN inspector going through a plant in Illinois observed a set-screw projecting on a revolving shaft. He considered it particularly dangerous because the shaft was near a passageway and workmen were continually going back and forth past it. He called the manager's attention to it. "Don't you think," he said, "that that set-screw had better be cut off? Someone will get hurt some day if it is left that way." "I don't think so," the manager replied, "that set-screw has been like that for years. No one has ever been hurt by it. The fact that it is exposed and can be observed by anyone renders it safe from causing an accident." This manager had a habit of gesticulating when speaking, and, as he waved his arm to emphasize what he was saying, the sleeve of his coat came in contact with the set-screw and caught on it, and in an instant he was whirled to death.

RAIL MILL SHUTS DOWN TEMPORARILY.

THE Dominion Steel plant rail mill shut down on January 8 for repairs. General Superintendent Martin said: "This is only for temporary repairs which could not be made with the plant running. You may be assured, however, that by the twenty sixth of this month, the works will again be in operation. It will please you to know that while, in common with many firms, in the summer time, on this continent, the Steel Company has felt the existing depression, all signs now indicate that 1914 will be a most prosperous year, and our company will naturally have its share, and thereby an exceedingly busy time throughout this year."

Continuous Manufacturing by Sequence of Operations*

By Oscar C. Bornholt

Continuous manufacturing appeals to all manufacturers who have a product requirement large enough to carry out the idea. The paper outlines such an arrangement of machines in use by a manufacturing plant that has been phenomenally successful.

CONTINUOUS MANUFACTURING.

IN any manufacturing enterprise, the cost of production is very important, and a great deal of money can be wasted if proper facilities are not provided. Even though a plant has the very latest and most efficient machines and fixtures, money can be unnecessarily spent in trucking. Trucking in the machine shop is always looked upon as an unnecessary expense, and yet many plants have a large trucking expense. This involves the question whether the manufacturing machines in a machine shop should be laid out in accordance with the sequence of operation, or whether they should be grouped according to the class of operation requiring like machines, such as placing together all milling machines, all drill presses, etc.

I will endeavor to show that the arranging of machines according to sequence of operation, as practised by the Ford Motor Co., has a great advantage over the classified machine grouping. In the former case, the operations on any part to be manufactured can be outlined according to the best advantage in manufacturing the part. It might be well, on account of the nature of the part to be manufactured, to have a milling operation first, then drilling, then milling, and it would not make any difference what sort of machine followed on each operation, but if the latter arrangement of grouping were decided upon, the operations would have to be arranged so that like operations on the same part would follow each other. For illustration, a milling operation should not come between two drilling operations so that the part would have to be trucked to the drill department first, then to the milling department, and then back to the drill department. Trucking is expensive and all its labor is non-productive.

The trucking item is immense in a large plant when the machines are arranged according to class, as all parts have to be trucked many times before they are finished. When machines are placed according to sequence of operation, there is no trucking of parts after the first operation is started, as each operator lays the part down in such a place and manner as to allow the next operator to pick it up and perform his operation, and so on. When finished, the part goes either to the finished stock room or assembling department.

Continuous Manufacturing Examples.

A good example of continuous manufacturing is found in the making of tin cans. The body of the can is started at one side of the building in a machine for forming it; it next goes to the body-soldering machine and then to the header which has been fed with the two heads; when the heads are on, the can travels upstairs to have these soldered. The first machine sets the pace and the operators of the other machines must keep their machines moving at a similar rate so that the stock will not run short or accumulate. This arrangement, therefore, helps to increase production.

At the Ford plant, the machines are arranged very much like the tin-can machines. All parts of a unit assembly are made on machines that are so laid out that the last operations bring them near together. This applies, of course, only to the large pieces, but all parts of a unit are made in one department under a foreman. Automatic screw machine parts are made in an automatic screw machine department where one man runs several machines. There would be no object or advantage in placing automatic machines among semi-automatic and manual operative machines. It is well understood that there are many operations that require more than one machine, but they are placed to draw from the one machine doing the previous operation. This gives the effect of the whole operation being done on one machine. The operations have to be gone over carefully to ascertain the capacity either by previous records or by good judgment. In many operations, more than one machine will be required, but there will not be work enough for two. Although the first cost may seem high, it is a great saving to have a machine for every operation and enough of them.

The carbonizing and hardening operations are awkward to have in the machine shop, but at the Ford plant a cyaniding and hardening department is placed in the middle of the machine shop.

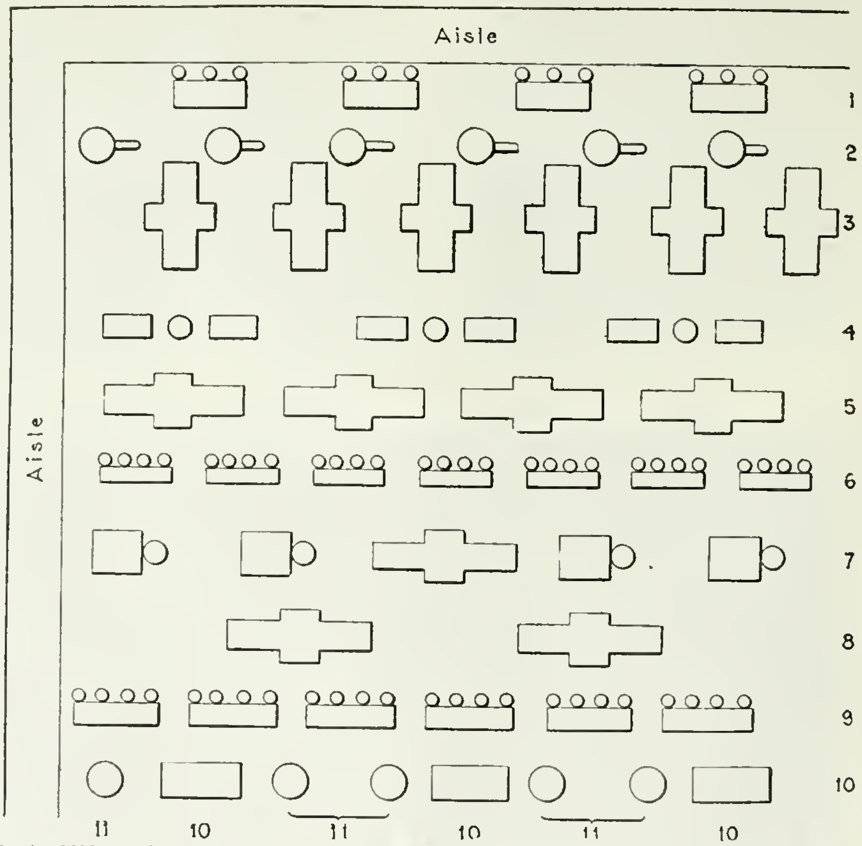


FIG. 1. SEQUENCE ARRANGEMENT OF MACHINES IN CYLINDER DEPARTMENT.

*From a paper read recently before the American Society of Mechanical Engineers.

It is glassed in and thoroughly ventilated with a separate system to carry off the fumes from the cyanide pots. All parts to be cyanided and hardened are led up to this department, and, thus, trucking amounting to several hundred tons of material a day to a separately located building is avoided. On account of the great amount of heat generated, the heat-treating and carbonizing departments had to be placed in a separate building where the walls could be opened 60 per cent. Brazing is done in the machine shop, just before the parts reach the assembling department. All shop furnaces are operated with low-pressure air — 1½ lbs.—and city gas.

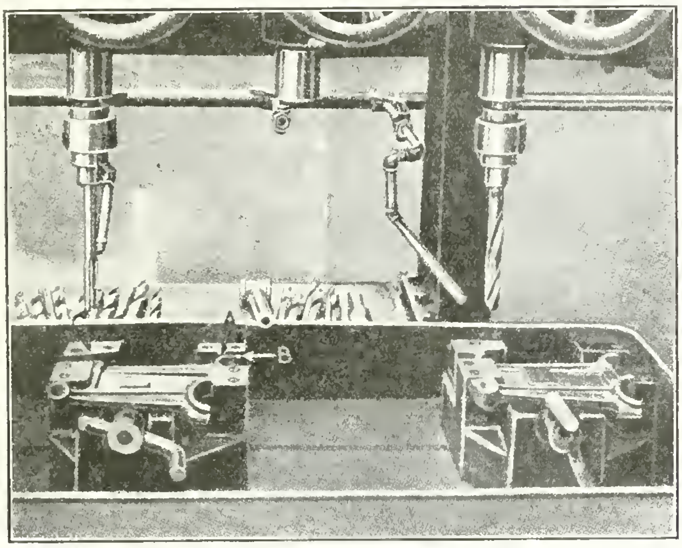


FIG. 2. DRILLING AND REAMING PISTON PIN HOLES

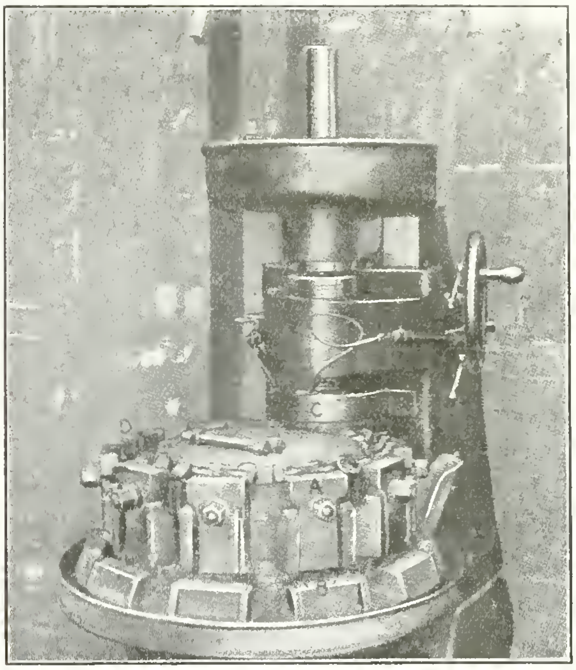


FIG. 3. CONTINUOUS MILLING OF CONNECTING ROD ENDS.

Illustration of Unit Production.

As an illustration of unit production, I will take the universal joint which has only four pieces and four rivets. Assuming that a production of 80 pieces per hour is required, it would take

80 universal joint knuckles, male;
80 universal joint knuckles, female;
160 universal joint knuckle rings, halves; and
320 rivets.

The universal joint knuckle, male, has six operations, as given in Table 1.

Table 1—Operations on the Universal Joint Knuckle

Operation.	Work.	Machines Required.	Capacity, per Hour.
First.	Mill square end	2 Millers	40
Second	Turn to size, 3⅛ in. diameter	1 Lathe	80
Third.	Turn trunnion ends	2 Duplex drills	40
Fourth	Mill ends, shoulder clearances	2 Millers	60
Fifth.	File	Bench for filing	
Sixth	Harden	Furnace in the hardening room in the machine shop, knuckle to be returned to assemble	

The operations on the universal joint knuckle, female, are similar. The rings are broached, and then ground on a disc grinder, which is placed in the machine shop. The grinder is equipped with a dust exhauster and collector so that no emery dust flies to other machines. After all the parts are completed, they are led up to an assembler who also rivets them. They are then inspected and sent to the finished stock room or the assembling department, usually the latter, since the production of the whole shop must be balanced up.

At the Ford plant, the cylinders are trucked from the foundry to the border of the aisle, down which are located the machines which perform the first operation. They are light enough to be carried by the operators to their machines while the latter are making cuts. The cylinders move to each successive machine until they land in the assembling department which borders the cylinder department. All cast iron parts are made in the same way. Some of the small parts have to be trucked to the assembling department, but in rare cases only. The trucking done at the Ford plant is taken care of by many two-ton monorail traveling hoists operated by electricity and forming a small railway system.

Cylinder Department Operations.

An illustration of the cylinder department for the first few operations is given in Fig. 1.

First operation—Drill, tap and plug three cored holes.

Second operation—Spot, face and inspect. This is one of the most important operations on the cylinder, since it detects any defect that might have occurred in the foundry. It also finishes spots to enable the placing of the cylinder in the jigs quickly and accurately. Many cylinders are thus saved in this jig because it is arranged to adjust the cylinder to ensure its being finished all over.

Third operation—Mill bottom.

Fourth operation—Drill six main bearing bolt holes and ream two of the holes for use in gauging or jigging. The drilling is done in a six-spindle inverted drill press and the two holes are reamed in a single-spindle drill press.

Fifth operation—Mill top and sides.

Sixth operation—Bore cylinder barrel.

Seventh operation—Water test.

Eighth operation—Mill ends of cylinder.

Ninth operation—Finish ream barrel.

Tenth operation—Drill valve seat holes.

Eleventh operation—Drill and ream valve-stem holes, etc., until the cylinder reaches the assembling department.

Machine Arrangement Comparison.

It may be of interest to compare the two ways of arranging machines for manufacturing by using the cylinder operations of various kinds. In placing the machines according to operation, it is necessary only to truck the cylinder to the first operation and after the last, because it is quite necessary to stock a few cylinders ahead of assembling. If the cylinders were to be machined in departments consisting of like machines, it would be necessary to truck to and from each department. Considering 1000 cylinders a day and the cylinders weighing above 80 lb. each, it would total 80,000 lb. to each department.

Grouping the operations on the cylinder to see how many times it is handled and in how many departments, there are drilling, milling, lathe, testing, tapping, babbitting, back to drilling, and grinding. It would be conservative to estimate that the cylinder would have to be trucked about 12 times. On account of some operations, it would have to return to a department in which it had already been, and would therefore be handled more times than there are departments.

Each handling will amount to 80,000 lb., or 40 tons, and 12 handlings will amount to 480 tons a day, while the total number of feet of movement for each cylinder will be at least 500. This makes 480 tons traveling 500 ft. at the probable rate of 180 ft. a min., which is about the gait of a man trucking. Assuming a man can truck 960 lb., or 12 cylinders, at the above rate of travel, and figuring the necessary time for loading and unloading as 10 minutes, it would require a force of 24 men with trucks to handle the 1000 cylinders per 10 hours.

Production of Small Forgings

While it may be claimed that the cylinder is especially adaptable to manufacture with machines placed in accordance with the sequence of operations, small forgings can also be produced in quantities much cheaper in the machine shop when the machines are placed in this way. The machining of connecting rods show how this system is applied where comparatively small forgings are used. These are brought in from the forging shops, and begin their passage down the row of machines which are arranged for the various operations. Nearly all of the machining operations consist of drilling, and the rods pass from one machine to the next, each being fitted to perform a specific operation. A typical view is shown in Fig. 2, where the wrist or piston pin hole is being drilled and reamed.

Adjoining this is a continuous milling machine shown in Fig. 3, the correct length being secured by having the piston pin hole slip over a suitable stud at the lower end of the fixture. The rods are held in pairs, as can be seen. As soon as the connecting rods are ready to receive the babbitt, they have reached one of the babbitting furnaces, shown in Fig. 4, which is very near to the last machine. The particular furnace shown happens to be babbitting the caps for the bearings, but is exactly similar in detail to the one which babbitts the connecting rods themselves. After babbitting, the rods are bored, and are then complete and ready to go to the assembling department.

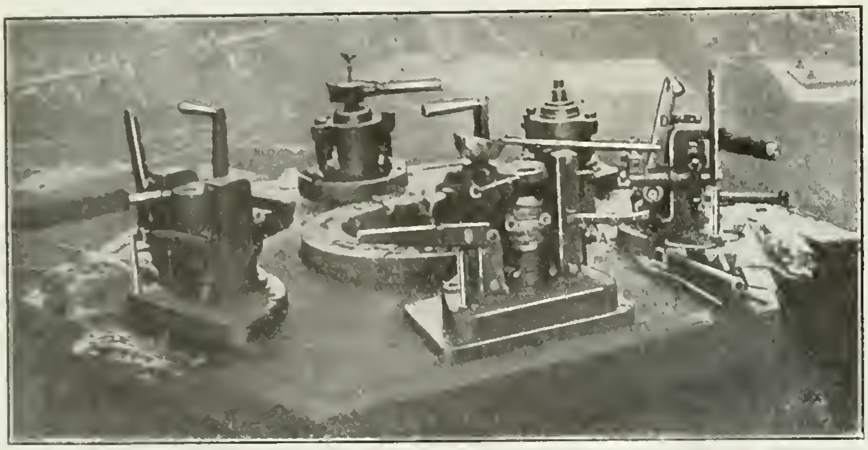


FIG. 4. ONE OF THE BABBITTING FURNACES FOR RODS AND BEARING CAPS.

There is another advantage in placing the machines in accordance with the sequence of operations, because, even though some machines are not worked to their full capacity, the amount invested in them is well paid for from the fact that it is not necessary to carry nearly so much stock as when the machines are grouped according to their classification. Each group or department alone would in that case need to have nearly as much raw stock to work with as is necessary with this method to operate the whole series of machines to complete the part.

GROWTH OF THE DOMINIONS.

HOW the King's Overseas Dominions have developed in fifteen years is set forth in the "Statistical Abstract for the several British Self-governing Dominions, Crown Colonies, Possessions, and Protectorates," just issued by the Board of Trade.

Exclusive of the United Kingdom, the area of the Empire is now approximately 11,253,000 square miles. In 1897, the population of this vast territory numbered 307,476,000. The figures for the last year are, of course, estimates only:

	1901	1912
Canada and Newfoundland	5,592,299	8,003,137
Commonwealth of Australia	3,773,801	4,733,350
Union of South Africa (1904) ..	5,175,824	6,211,900
New Zealand	772,719	1,052,627

In fifteen years the public revenue of Canada has grown from £8,382,000 to £34,675,000.

The following table shows the development of trade between the Mother Country and the principal parts of the Empire in the fifteen years covered by the return:

Imports From United Kingdom.

	1898	1912
British India ..	£40,218,301	£91,690,228
Australia	20,975,551	39,124,829
Union of South Africa	15,255,000	23,200,948
Canada	6,753,289	28,723,812
New Zealand..	5,148,833	12,499,787
West Africa ..	2,766,000	8,203,000
West Indies ...	2,510,900	3,766,974

Exports to United Kingdom.

	1898	1912
British India...	£23,468,005	£45,897,819
Australia	23,886,313	31,459,317
Union of South Africa	25,690,000	56,121,502
Canada	21,575,108	36,585,189
New Zealand...	8,265,499	16,861,256
West Africa ...	1,781,000	5,855,000
West Indies....	1,460,659	2,287,224

Imperial Mail.

Post Office business has fully kept pace with developments in other directions. Appended are some of the principal figures relating to letters and cards alone for 1912, together with the corresponding totals for 1901:

	1901	1912
British India...	469,209,000	850,889,000
Australia	220,852,000	479,672,000
Canada	229,859,000	652,153,000
New Zealand...	54,089,000	225,436,000
South Africa (1902)	42,400,000	130,788,000

Growth of Railways.

In the period under review the railways of the Dominions have been extended by many thousands of miles, and vast tracts of country have thereby been opened up for settlement. The following table affords an indication of the extent of the development since 1898:

	1898. Miles.	1912. Miles.
British India	21,930	33,484
Canada	16,718	28,035
Australia	12,483	18,679
Union of S. Africa....	2,862	8,393
New Zealand	2,257	2,889
Rhodesia	586	2,358

Hamilton, Ont.—The Dominion Power and Transmission Co. have awarded the contract for electrical machinery to develop 90,000 h.p. at its new steam reserve power plant on the bay shore to the Canadian Westinghouse Co., Hamilton. The order for boilers has been let to the Edge Moore Iron Works, Edge Moore, Del.

MACHINE SHOP METHODS AND DEVICES

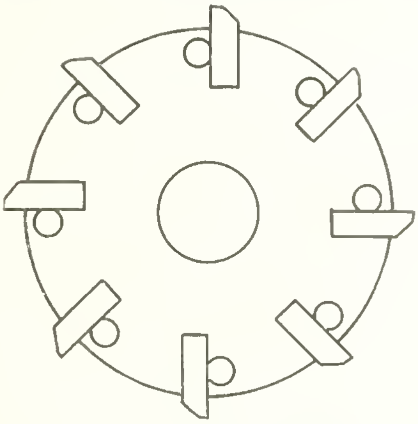
Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

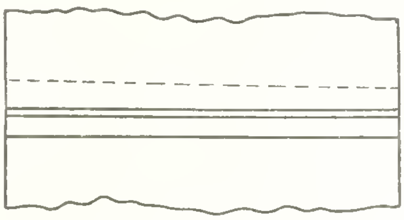
HOLDING THE TEETH OF MILLING CUTTERS.

D. S. Mann.

FOR fastening-in the teeth of milling cutters and boring heads, an excellent method is shown in the drawing. This is by means of straight pins which are put in at a slight angle to the face of the cutter, about two degrees. The holes are first drilled at the desired angle, preferably in the milling machine, using the dividing head so that the pins are driven in, being straight round pieces of drill rod preferably, although cold rolled steel will answer if the pins are not to be driven out often. Pins $\frac{3}{8}$ in. in diameter are suitable for medium size cutters.

The body of the cutter is then slotted for the blades, the proper angle for the pins being milled at the same time. There is thus no fitting necessary on the pins as they come exact, but they should be marked so that each may be used on its own blade. The less the angle the greater the holding power of the pin and vice versa, also the farther the pin may be driven. If the blades are to be set at an angle, it is only necessary to drill the holes at that much greater angle. This





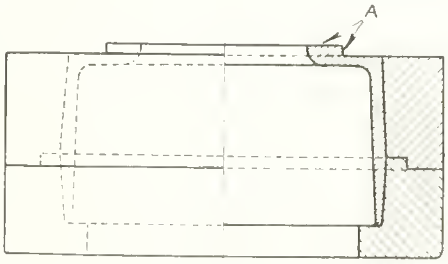
HOLDING THE TEETH OF MILLING CUTTERS

is one of the simplest and easiest methods of holding blades, as all fitting and extra work is eliminated, only the drilling and milling being necessary.

A CHEAP PULLEY.

By D. O. Barrett.

IN putting out a line of gasoline engines, it was decided to use interchangeable pulleys, bolting same to the flywheel by means of three capscrews. As the engines were put out as cheaply as possible consistent with the workmanship, it was decided not to machine the face of the pulleys. In order to get a smooth and true surface, the pulleys were cast in iron chills as shown in cut. The chill was heavy enough to prevent



A CHEAP PULLEY.

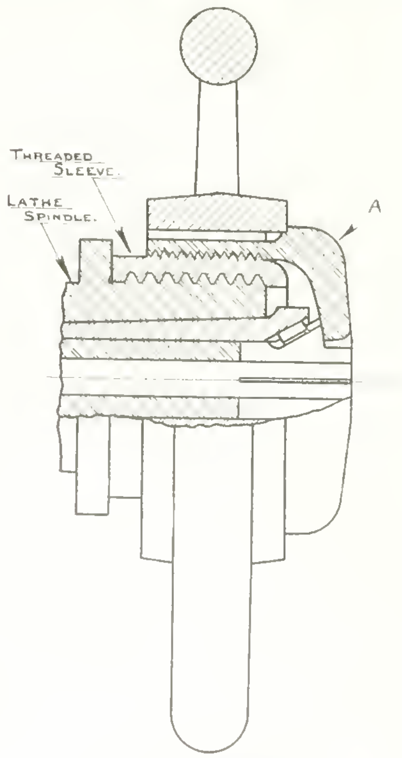
any distortion, and these chills have now been used for some time without any bad results. In order to crown the pulleys, the chills were made in two pieces, being turned with shoulders fitting properly.

For machining, the pulleys were grasped in a three-jaw universal chuck with soft jaws and the faces at (A) turned. As the pulley sat in the flywheel only about one-sixteenth of an inch it was not necessary to form a square shoulder, merely facing and turning to the proper diameter. The pulleys came out smooth and very round and no trouble was experienced with any of them. They were dumped out of the molds almost immediately after pouring, it being necessary to use very hot iron with a high head. The chilling did not in any way affect the turning.

A DRAW-IN CHUCK.

By D. O. Barrett.

ON account of a great deal of work which required to be done on valves, studs, shoulder pins, etc., the draw-in chuck shown by the drawing was constructed for use on a 12-inch engine lathe. Some of the work came through in large quantities and, as this was the only machine suitable for the purpose, it was necessary to have the operator make as few movements as possible. Were this chuck made as ordinarily used the head-wheel would have been placed at the outer end of the spindle and the operator would have to step out of his working position each time he changed his work. By having the handwheel directly on the nose of the spindle it was



A DRAW-IN CHUCK

handy for the operator and necessitated no change in position to reach same.

A tapered sleeve was slipped into the lathe spindle and bored out as large as possible with a straight hole for the collets. This sleeve could be fairly thin as most of the strain was at the front end. This end was bored to the same angle as the heads of the collets, the collets being provided with four slots to allow for the clamping action. On the nose of the spindle was screwed a sleeve, threaded

internally to correspond to the spindle and externally with a finer thread. This sleeve was screwed up tight and also released with the aid of a spanner. Turning on the sleeve is the piece (A) threaded to correspond to the sleeve and projecting over the ends of the collets.

It will be noticed that the collets have a straight portion extending through this piece (A). This was to support the stock as much as possible and prevent any overhang where it would be impossible to get at it with the cutting tool. Keyed to (A) is the handwheel which, when revolved, in the direction opposite to the motion of the spindle causes A to be screwed up on sleeve and, in turn, force in the collets.

This style of chuck is more applicable to the larger sizes of lathes, because on many of these the spindle does not run entirely through, being provided with a thrust bearing directly against the outer end of the spindle. It can also be applied just as well to a solid spindle, so that it would be possible to handle short pieces of round stock.

ROLLER AND BALL BEARINGS.

At the Institution of Automobile Engineers recently, Professor John Goodman, of the Leeds University, gave a lecture on the subject of roller and ball bearings. Professor Goodman has been making a consistent study of this question for fifteen years, in the course of which innumerable experiments have been made on various types of both ball and roller bearings under many different conditions of load and at various speeds.

Before dealing with the various criticisms he made, it may be well, says The Engineer, to give one of the most valuable results to which his investigations have led, namely, the establishment of a formula which will give the maximum working load in pounds to be allowed for any given ball bearing. The formula reads:—

$$\frac{K\,m\,d^2}{N\,D + C\,d}$$

where

m = the number of balls in the bearing.
d = diameter of the balls in inches.
N = revolutions per minute.
D = diameter of ball race, diameter being taken from the point of contact of the ball with the race, or for a thrust bearing D = the diameter taken from the centres of the balls.

The constants C and K are as follows:

For Thrust Bearings.

	C.	K.
Flat races	200	500,000
Hollow races	200	from 1,000,000 when the radius of the race is about twice that of the ball to 1,250,000 when the radius of the race is 9-16th that of the ball.

For Journal Bearings.

	C.	K.
Flat races	2000	1,000,000
Hollow races	2000	from 2,000,000 where the radius of the race is about twice that of the ball to 2,500,000 where the radius of the race is about 9-16th that of the ball.

Roller Bearings.

The lecturer dealt first with the question of roller bearings, and commenced by showing Osborne Reynold's diagram illustrating the manner in which the resistance due to friction occurs. The first point he impressed upon his audience was that when an elastic roller rolls on an elastic bed there is always slipping, and his tests show that the amount of slipping depends very largely upon the load, i.e., there is a small amount of slip with a very light load and a comparatively large amount of slip with a heavy load.

In the case of roller bearings, end thrust results in the rollers wearing right through the end of the cage, and, in addition, sets up a vibratory action, which enormously increases the friction of the bearing. A case was mentioned in which this vibration was so large in a particular factory that the bottles on the shelves of the chemical department overhead began to fall over, and the bearings had to be removed. End thrust, it was pointed out, may easily amount to a quarter or a third of the total load on the bearing. With a 10-ton load on a bearing, from 2¼ to 3 tons end pressure would be encountered, and the direction of the end thrust would always reverse when the direction of the rotation of the shaft was reversed. The case was also mentioned of forty or fifty railway wagons fitted with roller bearings which had to be put out of service owing to the amount of end thrust which in some instances had caused the casing to be worn right through.

This end thrust with roller bearings occurs however good the workmanship, although one form of roller bearing was illustrated in which the length of the roller was approximately equivalent to the diameter, and, whether due to this fact or not was not stated, the end thrust was almost absent. Comment was made upon the satisfactory service given by the plain roller bearings used in light railway wagons of the Koppel type, the bearings being practically pieces cut from mild steel rods with the ends rounded. The results obtained with this very cheap form have, curiously enough, been found to be almost equal to those of the most expensive type of roller bearing.

Professor Goodman also investigated the question of whether the efficiency of roller bearings was in any degree affected by the degree of accuracy in the workmanship, but he has come to the conclusion that it is not so, because, after going to the fullest possible trouble to obtain bearings of the highest class, the results obtained were no better than with the cheaper forms. Better results were achieved with long rollers, but these, he said, could not be regarded by any means as an unqualified success.

Summing up end thrust troubles, Professor Goodman said that the friction on the bearings was enormously increased, owing to end thrust. He could give many instances of the seriousness of the wear, and in addition there was the question of rumbling or vibration. With a properly designed roller bearing in which the end thrust was extremely small, the friction was, to all intents and purposes, independent of the lubrication, but when a large amount of end thrust manifested itself, then lubrication made a very considerable difference, for the simple reason that when there was little end thrust a pure rolling action was obtained, whereas with end thrust there was a large amount of friction between the ends of the cage and the flange of the casing. In these instances lubrication did good.

Friction with roller bearings has been determined to be almost independent of the speed, and in all roller bearings, bad and good, the starting effort is very little greater than the running effort, which was admitted to be a point in their favour for machinery constantly starting and stopping. With the worst type of roller bearing the friction was lower than in an ordinary bearing with poor lubrication, but a roller bearing in these conditions was not so good as a bearing running in a bath of oil.

Ball Bearings.

Passing on to the virtues of the ball bearing, the lecturer pointed out that with it there is no end thrust at all, and the friction is very much less than in the majority of roller bearings; hence, there was a good deal to be said in its favor. It might be said against this statement that a ball bearing only bears on a point, whereas the roller bearing bears on a line; hence, a ball bearing of a certain size could not possibly carry so high a load as a roller bearing.

He admitted that there was an element of truth in this, but it was not the whole truth. With equally good material in rollers and balls, and in the absence of end thrust on the roller bearing, the argument would hold rigidly, but since end thrust did come in with the roller bearing, with other troubles in consequence, practically any type of ball bearing was able to carry a much bigger load than any roller bearing.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same, direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals, will be found a most useful companion study, and should not be overlooked.

Question.—A system of pulley blocks is used to lift a weight of three tons, and if the number of sheaves in the blocks are such that 16 feet of slack is gained for every foot the weight rises, what power will be required if friction be neglected?

Answer.—Three tons is equal to 6,000 pounds; therefore, the pull required will equal $\frac{6000\times1}{16}$ or 375 pounds.

* * *

Question.—A mechanic exerts a pull of fifty pounds at the end of a three-foot spanner, and the nut which he is tightening has a pitch of four threads per inch; if friction be neglected, what stress would he bring to bear on the bolt?

Answer.—Let us suppose a revolution to take place, then the end of the lever in the operator's hand would pass through a space which is the circumference of a circle whose radius is three feet, while the nut would move 1/4 inch. The circumference corresponding to 3 feet is 226 inches, therefore, the ratio of motion is 226 to $.25=\frac{226}{.25}=904$ to 1, and the stress on the bolt being tightened, would equal 50×904=45,200 pounds.

* * *

Question.—A pressure of 10 pounds acts at one end of a system of levers, and it is found that if motion were to occur, the end where this pressure acts would move through a space 40 times as great as the other end. What pressure would be exerted on the latter?

Answer.—The motions are 40 to 1 and, since the pressures are inversely as the motions, the pressure required would equal $\frac{10\times40}{1}$ or 400 pounds.

* * *

Question.—A balance weight attached to the crank of an engine weighs 4,000 pounds, and the distance where its mass may be supposed to be concentrated is 1½ feet from the centre of the shaft; the revolutions are intended to be 120 per minute, and two is the number of bolts determined upon to secure the balance weight. What should be the size of the bolts if they are of 62,720 pounds tensile strength, and with an assumed factor of safety of 10?

Answer.—The circumference of 1½ feet radius is 9.427 feet; therefore, the circumferential velocity at 120 r.p.m. will be 9.427×120=1,131 ft. per minute, or 18.85 ft. per second. The centrifugal force or tension on the bolts will be $\frac{4,000\times18.85^2}{32\times1.5}$ or 29,527 pounds, which is 14,763 pounds to each bolt. As the tensile strength of the bolt material is 62,720 pounds and the factor of safety 10, therefore $\frac{14,763\times10}{62,720}=2.35$ square inches area at the bottom of thread, equivalent to 2⅛ in. diameter and 4½ threads per inch. The figure 32 used in the calculation is the acceleration due to gravity in feet per second.

* * *

Question.—Express by means of a formula how the dead load at the pitch circle of a gear wheel to transmit the required power is computed.

Answer.—Multiply the horse-power to be transmitted by 33,000 and divide by the velocity of the pitch circle in feet per minute. Example, if the horse-power to be transmitted is 500, and the pitch circle velocity be 2,000 ft. per minute, then $\frac{500\times33000}{2,000}=8,250$ pounds, or the maximum load at the pitch circle.

* * *

Question.—A feed pump has to discharge 1,925 pounds of water per minute against a pressure of 90 pounds per sq. inch, and the area through the valves is 2 sq. inches; neglecting friction and loss from restricted discharges, etc., what would be the horse-power required?

Answer.—Since the fluid is water, the head corresponding to 90 pounds pressure equals 90×2.31, or 207.9 feet. The discharge per second will be $\frac{1,925}{60}$, or say 32 pounds, and since a cubic inch of water weighs .036 pounds, the discharge will equal $\frac{32}{.036}$ or 900 cubic inches per second. Also, since the area through the valves is 2 sq. inches, the velocity will be $\frac{900}{2}$, equal to 450 inches per second, or 37.5 feet per second, and the head necessary will be $\frac{37.5^2}{64}$ or 22 feet. The total head required equals 22×207.9, say, 230 feet, and the horse-power will be $\frac{1925\times230}{33000}$ or 13.4

* * *

Question.—Steam is expanded to 10 pounds absolute pressure, and it is desired to have the feed water at 130 degrees, the temperature of the injection water being 86 degrees, how many pounds of injection water, per pound of steam condensed, will be required?

Answer.—The total heat of steam at 10 pounds absolute is 1172.3 thermal units, therefore the ratio required is $\frac{1172-130}{130-86}$, or 23.7 to 1. The common allowance for engines with surface condensers is 24 to 30 times the weight of steam condensed, and for engines with jet condensers, from one-third to one-half the cylinder capacity.

* * *

Question.—Why do the driving wheels of a locomotive frequently slip at starting, and how does the application of sand overcome the difficulty?

Answer.—If the tractive force exerted by the locomotive exceeds the frictional resistance at the rails due to the adhesion of the driving wheels, then the wheels will slip. The resistance to slipping varies with the condition of the rails, and is greater when they are dry or wet than when they are merely damp. The application of sand to the rail, of course, increases the friction and enables the driving wheels to obtain a grip. To avoid slipping, the tractive force should not exceed about 22 per cent. of the weight on the coupled wheels.

* * *

Question.—A bucket conveyor driven by an electric motor is used for lifting coal from a railroad car to a hopper 50 feet above the car. If 40,000 pounds of coal are raised per hour, find the horse-power of the motor. Assume the combined efficiency of motor and conveyor to be 60 per cent.

Answer.—$\frac{40000\times50}{60}$ foot-lbs. of work done per minute. Since the efficiency of motor, etc., is only 60 per cent., the horse-power required will be

$$\frac{40000\times50\times100}{60\times33000\times60}=16.83 \text{ h.p.}$$

CANADA'S DEBT $303,562,104.

THE national debt of Canada now stands at $303,562,104, an increase of about half a million during December, according to the financial statement issued on January 10. The funded debt payment in Canada is $803,460, and, in London, $267,541,621. There have been considerable increases in both ordinary and capital expenditure, the latter due to large outlays on public works throughout the Dominion.

The revenue during December amounted to $12,931,466, of which seven and one-half millions was derived from customs. The expenditure was a little over nine and one-quarter millions. December's net revenue shows a decrease of a million and a quarter, compared with December, 1912. For the nine months of the present fiscal year the revenue was $127,571,762. This is an increase of three millions over the same period last year, despite the falling-off in customs receipts during the past two months.

Expenditure Increases.

Capital expenditure on public works, including railway and canals, amounted to $3,407,611 during December. Railway subsidies were half a million. This expenditure is about the same as December, 1912. For the nine months of the present year the amount was $40,828,951, an increase of $18,000,000 over the same period last year. The $15,000,000 subsidy to the Canadian Northern accounts for most of this.

In customs revenue there was a net decrease of $391,215, the figures being $82,738,294, as against $84,747,008, but from the latter must be deducted $1,817,-499 of Chinese revenue, which is this year included as "miscellaneous" revenue, so that the actual customs receipts for the nine months of 1912 were $82,-929,509.

Big Receipts.

In excise revenue there was an increase of half a million in post-office receipts, an increase of $775,000, and in receipts from public works, railways and canals an increase of one and three-quarter millions.

Expenditure on ordinary account for the nine months totalled $75,987,925, an increase of $8,986,350. Capital expenditure shows an increase of $18,158,848, due, as stated, to large outlay on public works and payments of railway subsidies. The total capital expenditure for the nine months was $40,828,951, as against $22,670,103.

NEW CONSTRUCTION ON C.P.R. CURTAILED.

MR. GEORGE BURY, vice-president of the Canadian Pacific Railway, before leaving for Winnipeg last week, after a number of conferences with Sir Thomas Shaughnessy on questions involving western expenditures, which, it was stated, must for 1914 be almost entirely confined for the present to the completion of track-laying, etc., on grades already built, on branch lines, extensions and double-tracking, the latter of which will eventually connect Winnipeg with Vancouver, and on the building of the Rogers Pass tunnel, which will be pushed with vigor. The consideration of expenditures on any new railway construction or other works will come up later in the year.

Mr. Bury said that "Under the direction of Sir Thomas Shaughnessy, C.P.R. expenditures have always been directed in accordance with the actual exigencies of traffic and with the building up of Western Canada, and it was owing to this comprehensive policy that the C.P.R. in 1913 was able to move such a large grain traffic so expeditiously at a time when the great strain of moving the harvest came. The facilities provided in rolling stock were such that car requirements in other directions were able to be met promptly and other traffic moved concurrently with the grain."

PROTECTING BELTS, SHAFTS AND PULLEYS.

THE accompanying instructions have been issued by a Chicago concern relative to the prevention of accidents due to contact with moving belts, shafts and pulleys:—

Belt, rope and cable transmission shall be arranged, so far as possible, to be easily guarded.

Pipe or angle railing placed 18 inches from the pulley or belt shall be provided where there is little danger of anyone getting caught by the belt.

Wire-mesh or perforated-plate casing shall be provided where the location of a belt is such that persons are liable to get caught between the belt and the pulley.

Where the belt is located in such a position that, should it break, flying ends will strike persons passing by the belt, it should be inclosed by a suitable guard.

The full width of a belt should be allowed between two pulleys or a pulley and a hanger on shafting so as to prevent the belt from becoming wedged and possibly pulling down the line shafting.

Belt splicing shall be made so as to eliminate ragged edges or projections which might catch employees' clothing. Endless belts are recommended, especially for high-speed machines.

Belts should be inspected frequently and kept in a condition to avoid accidents. Tight belts should be avoided.

Wherever it is necessary to shift belts, a mechanical device should be provided.

Where it is necessary to unship a belt, a hook or belt-perch should be provided to prevent the belt from resting on the shaft.

Shafting not over 12 inches above floor should be covered.

Shafting over 12 inches and not over 7 feet above floor should be encased or railed off.

Exposed ends of shafting shall be encased or otherwise guarded.

Overhead shafting which must be oiled should be equipped with a walk for the oiler, if practicable.

Electrically driven shafting should be provided with a safety switch, to be used when men are working on it. This switch should be placed at the top of the ladder or in some place where no one will tamper with it.

Shaft couplings should be guarded where safety couplings are not used.

To prevent gears or pulleys from working off the ends of shafting, shaft ends shall project at least the diameter of the shaft beyond the hub of the gear or pulley, so that the key can be locked in place.

Hangers for shafting shall be particularly strong and well secured.

All projecting keys in shafting, when exposed so that a person might get caught thereon, shall be guarded or cut off.

Wherever possible, cotter pins or spring washers should be provided to prevent nuts from working off the ends of bolts.

Setscrews must be guarded, countersunk or placed in safety collar with flanges high enough so that the setscrew head will not project above the flange.

Because of the dangers incident to hoisting material by means of line shafting, it is forbidden that any hoisting be done in this manner. All hoisting shall be done either with hand tackle and block, or with regular hoisting machinery.

Chary About Exhibiting.—The Canadian Associated Press understands that British manufacturers are showing a lukewarm attitude towards the proposed exhibition train to tour Canada. Some firms are convinced their goods could not be adequately advertised under such conditions, but in any circumstances it would have been surprising if the average British firm with inherited conservative instincts, had embraced such a proposal with enthusiasm. It is understood, though, that several firms who hitherto held aloof have been strongly urged by their Canadian agents to associate themselves with the scheme. The exhibition train promoters hope to sell advertising space to the value of $150,000.

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

UNIVERSAL TOOL ROOM LATHE.

THE Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, new model universal tool room lathe is made in 16 inches nominal size, but actually swings 18½ inches. To meet the requirements of various users, different types of headstock may be furnished, viz., 4-step and 5-step cone single back geared, 3-step cone double back geared, and "selective head" for single pulley belt or motor drive. As the universal tool room lathe is designed especially for tool room work, it has certain refinements and attachments not required in lathes for manufacturing purposes. The unit system of construction is employed throughout, so that the application or omission of various attachments which can be furnished will in no way affect the other parts. All of these lathes are made to jig and template, and are drilled, planed, and fitted to master plates, so that attachments ordered subsequently can be readily applied by the customer.

Fig. 1 illustrates the 16 in. x 6 ft. "selective head" universal tool room lathe, with full additional equipment, comprising pan, universal taper attachment, universal relieving attachment, translating gears for cutting metric threads in addition to English threads, draw-in chuck with collets, and step chuck with closer. Fig. 2 shows 16 in. x 6 ft. 4-step cone head universal tool room lathe without additional appliances.

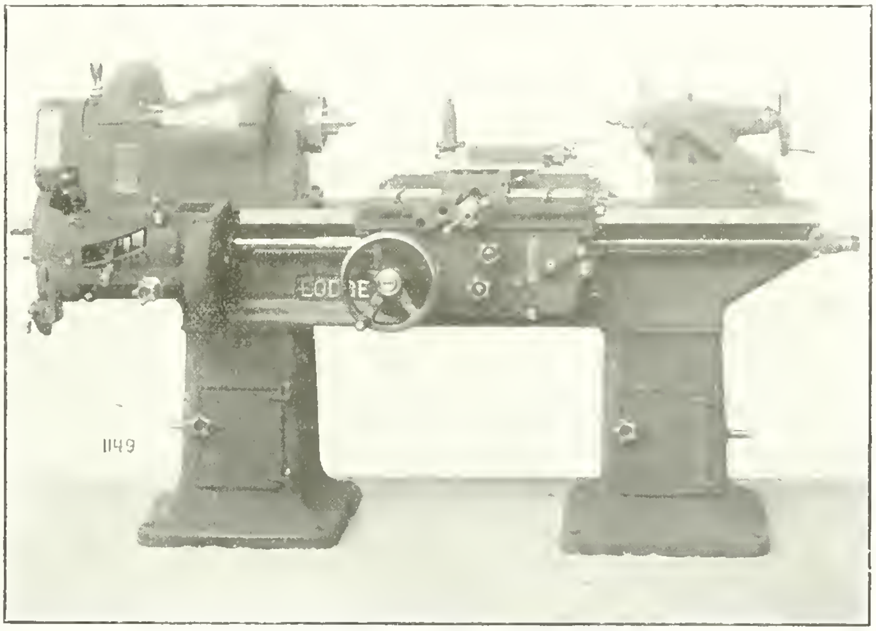


FIG. 2. 16 IN. X 6 FT. FOUR STEP CONE HEAD UNIVERSAL TOOL ROOM LATHE.

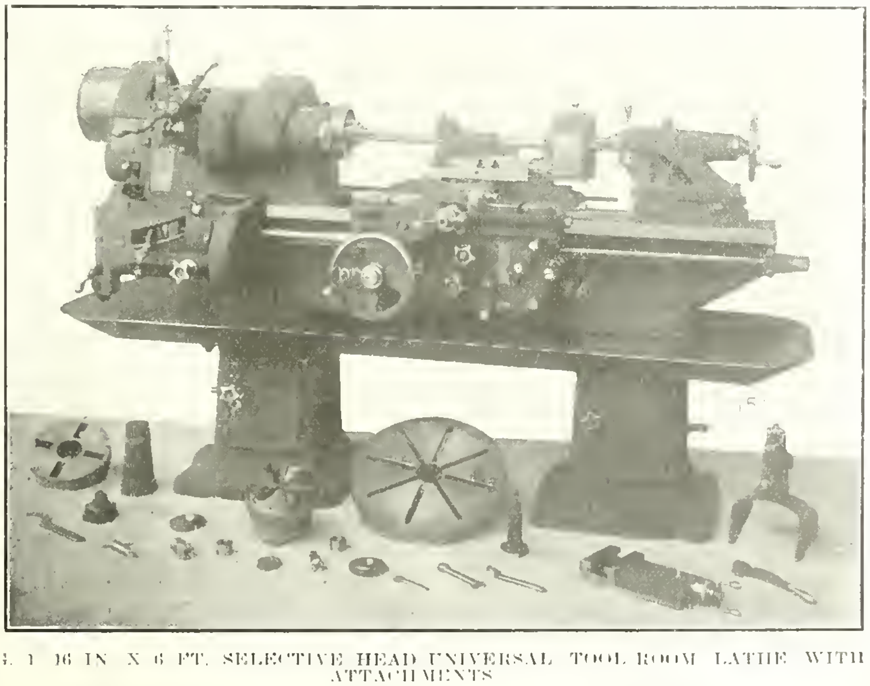


FIG. 1. 16 IN. X 6 FT. SELECTIVE HEAD UNIVERSAL TOOL ROOM LATHE WITH ATTACHMENTS

Selective Head.—As the "selective head" was described in Canadian Machinery of July 10, 1913, it is sufficient merely to mention here that when driven by constant speed belt or motor, the "selective head" gives 12 changes of spindle speeds, obtainable through conveniently located shifting levers, and that this head derives its name from the selective type transmission used in the gear box where there are chrome-nickel steel heat-treated gears mounted on chrome-nickel shafts running in ball bearings.

Spindle Nose.—The double nose for the spindle, as formerly described in conjunction with the "selective head," is used in both the selective and the cone head lathes. It provides a pilot for centering the chuck or face plate, and a large diameter of shoulder against which the plate is screwed.

Cone Head.—As illustrated in Fig. 2, the main housing of the cone head is carried up slightly above the centre line of the spindle. This makes a very rigid construction and ties the front and rear spindle bearings securely to each other and to the head.

Back Gearing.—In each of the different styles of heads, the back gearing is designed to give uniform progression over the entire range of speeds. On the 3-step cone head, the double back gear is moved lengthwise by means of a lever conveniently located at the top of the headstock cover. In the "selective head" the back gearing is located at the front of the head and the face gear pinion may be withdrawn from mesh. The back gear sleeve and pinion are both cut from a single steel forging.

Spindle Bearing.—The spindle bearings are of special white metal, interchangeable and replaceable, fitted and held into the headstock by screws. These bearings are faced and turned in halves

to exact standard size and the screw holes are drilled to jig. The end thrust of the spindle is taken against the rear housing by alternate hardened steel and bronze washers.

Lubrication.—Oil wells are provided over the spindle and back gear bearings, and a wick oiling system delivers the proper quantity of oil by capillary attraction. All bearings in the quick change gear mechanism and apron are reached by suitable oil tubes.

Tailstock.—The tailstock has a long bearing on the bed, and is designed to allow the compound rest to be set at 90 degrees when using the tool on small diameters. Set over screws are provided, and a hardened scale is secured to the lower side. Plug clamps lock the spindle without throwing it out of line. The spindle is made of tool steel, graduated lengthwise on top for quick reference, and has a long traverse.

Bed.—The bed is of box section, wide and deep, and the legs are set in from the ends. The ways are chilled, which greatly increases the life in alignment. The girders are as wide as the space between them. The six-foot bed has three girders, all of which are of the inverted U type. A planed pad is located directly under the headstock, and this pad receives the quick change gear box, which is tongued and bolted to it. A coarse pitch steel rack is bolted to the bed directly back of the lead screw. The lead screw is placed well up under the front carriage "V."

Carriage.—The carriage, a top view of which is shown in Fig. 3, has an unusually long bearing on the outside shears. It is gibbed at the front, back and inside. The bridge has a supplementary bearing on the inside front shear of the bed for resisting the pressure of the cut and absorbing the vibration from the cutting tool. An oil trough is cast entirely around the carriage, and shear wipers are provided for the bearing surfaces. The cross feed screw has a large self-locking micrometer dial graduated to thousandths of an inch. All carriages are planed and drilled to receive either style of taper attachment, and also to receive the relieving attachment, and no additional fitting is required when applying these parts.

Compound Rest.—The compound rest top slide is provided with large self-locking micrometer dial, graduated to thousandths It is designed so that the extreme width of the swivel rests directly upon the lower slide, thus avoiding overhang of the top slide. The lower slide is graduated on a vertical plane 90 degrees either side of zero.

Apron.—The apron is of the double plate type, and is provided with all steel feed gearing throughout. The hand wheel for imparting hand motion to the apron can be disengaged from the stem while chasing. All shafts have unusually long bearings, and oil receptacles are provided to properly distribute the oil to all bearings. The half nuts interlock with the friction feed mechanism. The apron is tongued and bolted to the carriage, and the pinion engaging the rack on the bed is made of high carbon steel and hardened. The lead screw is set well up under the front carriage "V" to avoid overhang.

Quick Return.—An entirely new quick return of the carriage for screw cutting is embodied into the design of this machine and incorporated in the apron. The reverse is by friction, and is controlled by the movement of the same lever which opens the half-nuts. By raising the half-nut lever, thus disengaging the half-nuts, the carriage stops. If the lever is raised slightly higher, the quick return mechanism is engaged, and the carriage returns four times as fast as the speed at which the thread is being chased.

Chasing Dial.—A new design of chasing dial is provided, which has a hardened notched disc mounted upon the shaft, which is secured to a worm wheel which engages the lead screw threads. This notched disc has longitudinal movement, and any selected index may be engaged with the stop dog which prevents the half-nuts from becoming engaged until the proper notch in the disc is presented to the dog. This preserves the accuracy of the lead screw on account of preventing the half-nuts from clamping on the tops of the threads, and it is also valuable in that the operator need not watch a dial.

Automatic Chasing Stop.—Fig. 4 illustrates the automatic chasing stop which is attached to the dovetail of the carriage by a clamping screw, and is directly connected to the lower slide of the compound rest. Its function is to form a dead stop for succeeding cuts over the thread. The rate of advancement or depth of cut can be adjusted to thousandths of an inch by knurled screws, and this cut may be varied from .002 in. to .010 in. of depth. The setting of the depth of cut is accomplished by withdrawing the cutting tool from the work. In using this device, the operator need not watch the micrometer dial, but can chase the thread to the proper depth, the rest at all times coming directly against the dead stop. This chasing stop prevents breaking the point of the tool, and with the quick return reduces chasing to a very simple operation.

Quick Change Gears.—The quick change screw cutting and feeding attachment is bolted to a pad on the front of the bed underneath the headstock. This attachment has two shaft centres, one for the lead screw, the other for the cone of steel gears. The sliding tumbler is supported in a slide independent of the shaft bearings, and this slide is arranged close to the handle which moves the sliding tumbler within the slot, thus avoiding overhang of the handle and preventing binding and cramping when setting. Both

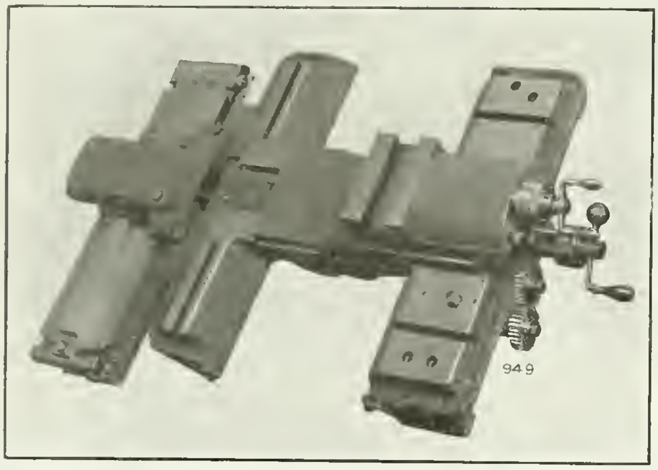


FIG. 3. TOP VIEW OF CARRIAGE WITH UNIVERSAL TAPER ATTACHMENT.

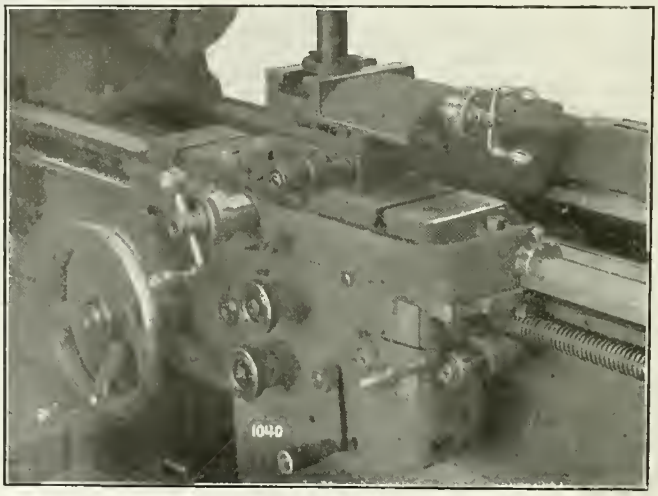


FIG. 4. AUTOMATIC CHASING STOP.

shafts of the gear box extend through the left end of the box and the change gear may be applied to either of these shafts. Power is transmitted from the feed gear on the end of the spindle through a reverse plate to the stud in the headstock, then through a quadrant mounted on the end of the gear box which quadrant gives three changes. The gear box itself gives thirty changes, so that, with the quadrant compounding, 90 changes are provided in the regular quick change gear mechanism. The housing carrying the sliding tumbler is locked into position before the intermediate gear can be meshed with the selected gear of the cone. All the shafts are short and the drive is direct. The index is simple and is attached to the top of the box where it can readily be seen by the operator. The machine may be ordered with the plain English threading index, and the Metric attachment can be subsequently supplied without any additional fitting.

Metric Treads.—With metric index it is necessary to make the cone of gears the drivers, whereas in the English index it is necessary to make the cone of gears the driven. When supplying the machine with metric attachment, it is only necessary to add a gear cover, into which are mounted the translating gears. This gear cover is machined and made a duplicate of a plate which is secured to the gear box when the metric compounding gears are not supplied. When the gear box is arranged for metric pitches, it is possible to cut either metric or English by simply turning a knob attached to the bottom of the box. By turning this knob to the left, the metric pitches are obtained, and to the right the English. It is also necessary to place the driving gear at the end of the gear box on the proper shaft; the upper shaft for the English and the lower for the metric.

Plain Taper Attachment.—The taper attachment requires no planed strip on the back of the bed, and therefore a special bed is not required, and the taper attachment can be readily applied to the machine at any time. All carriages are drilled to receive it. The bracket carrying the swivel bar is bolted to travel with the carriage so that at whatever part of the carriage the taper attachment may be, it can be instantly engaged. The taper attachment slide is provided with an extension which may be connected on either side, and this extension engages the arm which clamps it to the bed and holds it stationary when the carriage is feeding. The taper attachment swivel is a steel straight edge. A gibbed shoe slides upon it, which is secured to a slide which confines the cross feed screw to it.

The cross feed screw telescopes through the cross feed pinion on the front side of the carriage, thus the taper attachment may be used with a plain rest or with a relieving attachment, and the depth of cut set by the cross feed screw. The hardened steel straight edge can be set to graduations in inches per foot, and a micrometer adjustment is provided to give extreme accuracy in setting. A nicely graduated steel scale with a compensating pointer gives accurate reading to the swivel bar.

Universal Taper Attachment.—In addition to the parts above described for plain taper attachment, the universal taper attachment has a power traversing mechanism which slides it through its bracket at various rates of travel. Fig. 3 illustrates the universal taper attachment fitted to carriage. A cover plate which protects the taper attachment rack and a cover for the gears on the front of the apron are purposely omitted to give a clearer idea of the construction. The mechanism for giving power traverse to the swivel bar of the universal taper attachment is controlled by a shaft extending through the bridge of the carriage and operated by change gears at the front, driven direct from the apron feed train. Thus, when the universal traversing mechanism is employed, the forces necessary to produce the taper are all contained within the carriage and all side pull is eliminated.

The plain taper attachment is satisfactory for tapers not exceeding 4½ in. per foot, but, on very abrupt tapers, it is of course, impossible to drive the tools against such steep angles, and to accommodate work of this character we have provided the independent driving mechanism to the taper attachment slide. Since the slide may be fed at various speeds, it is capable of turning much longer tapers than with the plain taper attachment. In other words, if the slide feeds one-third as fast as the carriage, the carriage will travel three feet while the slide is travelling one foot, and vice versa. The complete range of the universal taper attachment covers tapers from 1½ in. to the foot and 54 in. long, up to 13¼ in. to the foot and 6 in. long.

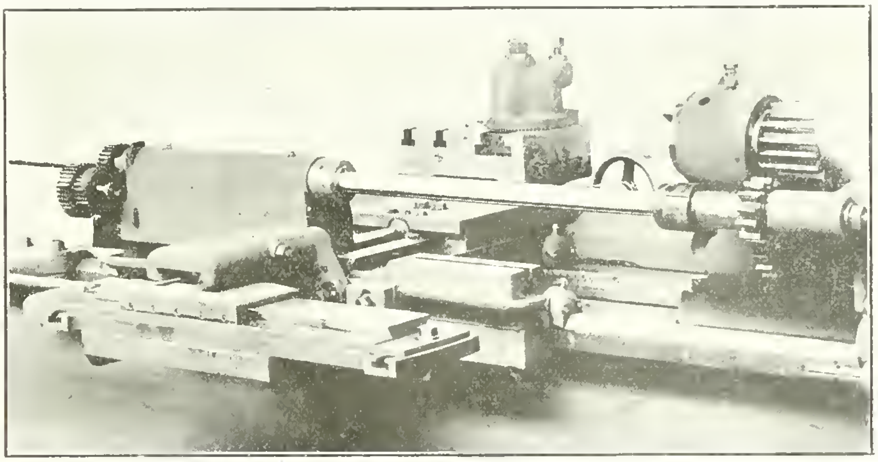


FIG. 5. REAR VIEW OF UNIVERSAL RELIEVING ATTACHMENT

Universal Relieving Attachment.—As illustrated in Fig. 5, this device is designed to produce radial, angular, end, or inside reliefs. It is never necessary to go behind the machine to make adjustment. Power is transmitted from the splined shaft at the back of the bed, through the sleeve and change gears, to a shaft below and parallel with the driving shaft. The lower shaft in the housing transmits its power through hardened spiral gears to the cam shaft which takes its bearing in the cross slide. This cam shaft engages a roller mounted in a plunger. The plunger engages a bell crank which is mounted in the top slide of the relieving attachment. The abutting portion of this bell crank is made adjustable by an adjusting screw and, by removing the top cover, this screw may be adjusted for various depths of relief from zero to ⅛ in. movement of slide.

Since the power for operating the relieving slide is supplied directly through the swivel centre, the swivel itself may be set at any angle without affecting the movement of the slide, thus, it is possible to relieve at any angle, inside or outside, or on the face of a piece of work. The cam shaft is placed below the surface of the bridge so that the full swing over the bridge is obtained for relieving.

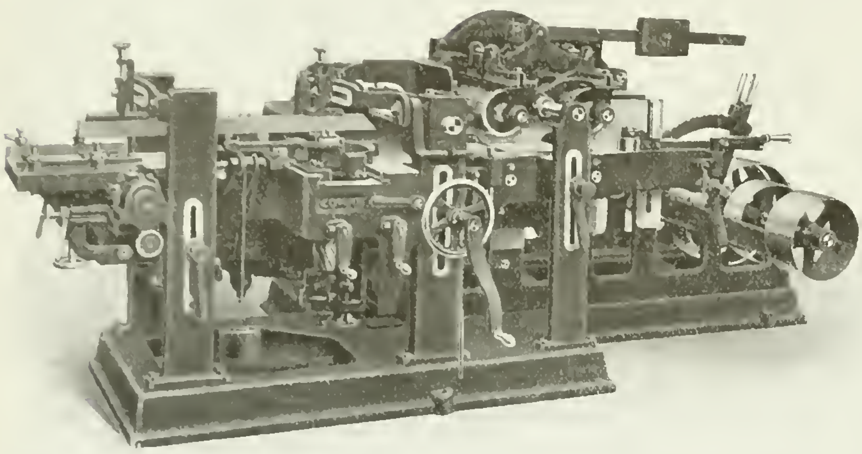
Draw-in Chuck and Collets.—The draw-in chuck is mounted directly on the nose of the spindle, which makes it possible for the draw-in collet to receive stock as large in diameter as the size of the hole through the spindle. Collets may be furnished for diameters from ⅛ in. to 1 5-16 in., both inclusive. The collets are tightened and released by a small key wrench, which makes it unnecessary to hold the driving belt when tightening and releasing the chuck.

Step Chuck.—A step chuck with adjustable jaws and closer is made to apply to the regular draw-in chuck body and is very desirable when a finished piece must be true, also for facing thin pieces of large diameter.

NEW DESIGN MOULDER.

WE illustrate herewith a new design moulder recently put in the market by Cowan & Company, of Galt, Ltd., which has many features that will be of particular interest to woodworkers. The machine is made in two sizes to work 10 in. or 12 in. wide, four sides. The table or bed lowers 8 inches.

Particular attention is drawn to the few gears, and the large diameter of same, with which the machine is equipped. These are all covered, making the machine, as nearly as possible, in this respect, proof against accident. It is fitted with the Cowan patent compensating gear drive which provides a suitable mechanism between the driving gears and rolls to compensate for any variation of speed that may occur between the different rolls as they rise over the varying thickness of stock. This is particularly serviceable in preventing the locking or binding between the rolls and gears which takes place when thick and thin boards follow each other.



NEW DESIGN MOULDER.

The guide roll on feed end, and the guide spring are held by a new guide spring clamp for which a patent has been applied for. This provides a rapid and secure clamp as well as preventing the burring or marking of the shafts.

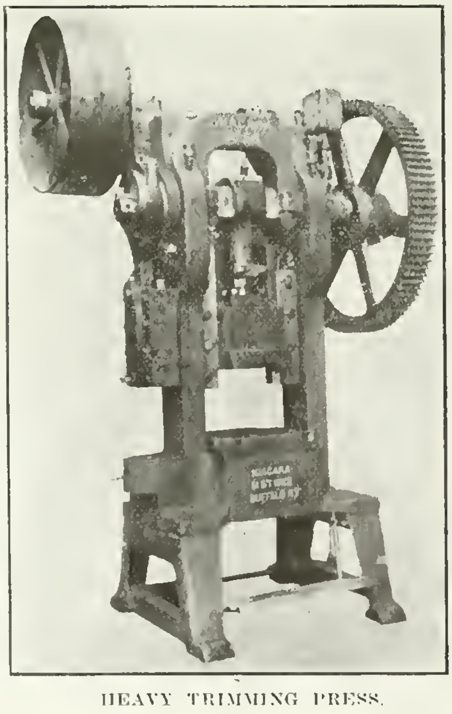
Both top and bottom spindles are fitted with self-oiling thrust block to take up end play. This consists of a hard steel collar shrunk on end of spindle, ground accurately to size and running freely between the end of the box and phosphur bronze thrust block equipped with simple take-up device. The whole arrangement is submerged in oil.

Another feature is the outer bearing for upper head which is attached to the post. This is arranged so that should it wear out of line or the bed be set on an uneven floor, by loosening the clamp bolts on the bearing, it will automatically adjust itself to line of the spindle. On setting up the machine, the binding bolts are slackened, which allows the spindle to come to its natural place.

As will be seen by the illustration, the machine is very rigid and substantial and the attachments and adjustments make it suitable for all classes of heavy or light moulding, flooring, shiplap, etc.

NEW DESIGN, HEAVY TRIMMING PRESS.

A NEW design of trimming press has been built by the Niagara Machine & Tool Works, Buffalo, N.Y. It is intended for trimming drop forgings and heavy sheet metal work and for use in the manufacture of hardware, automobile and bicycle parts. This machine differs materially from the general run of trimming presses, which heretofore have been built with the flywheel and pulley adjoining the main gear, and with an outboard bearing to support the overhanging part of the driving shaft. In this new press the flywheel, pulley and backshaft are mounted on top of the machine, and the outboard bearings are entirely eliminated, thus making the machine self-contained. In this way, a minimum amount of floor space is occupied, and the press is accessible from all sides, thus enabling it to be placed as close as possible to the drop hammers, in conjunction with which it is used.



HEAVY TRIMMING PRESS.

The motion of the press is controlled by an automatic jaw clutch, with a gravity releasing device. The inner slide has a dovetail recess to facilitate the mounting of trimming and forming dies. The outer slide receives its motion from an eccentric keyed to the main shaft and a steel pitman, and is used alternately with the inner one. Both the outer slide and the bed have machined recesses so that adjustable holders with cutting-off tools can be attached, if desired.

These presses are built in different sizes, with single or double crankshafts, and with either straight or gap housings. The weight varies from 5,000 to 60,000 lb.

PAPER BAG MACHINE.

THE machine herewith illustrated, for the production of heavy paper bags, contains many new features and improvements that combine to make it worthy of attention.

The machines are designed with a view to high production at a minimum of cost for labor and power. They are very compact, requiring but small floor space. The mechanical construction is of a high order, every part being made and finished from materials which ensure long life and efficient service. The machines have a capacity ranging from 20,000 for 1/4 barrel bags to 25,000 for 1-16 barrel bags per day of ten hours. The bags are made complete in every detail including printing in one color, the product being ready for marketing by one continuous operation.

Electric stops are provided which automatically control the action of the machine, and instantly stop it if there is a break in the operation. These stops may be set at any desired points to govern the work. A counting and registering clock with bell attachment is provided to count and register the production. The bell rings with every 25 bags made while the clock registers the daily output.

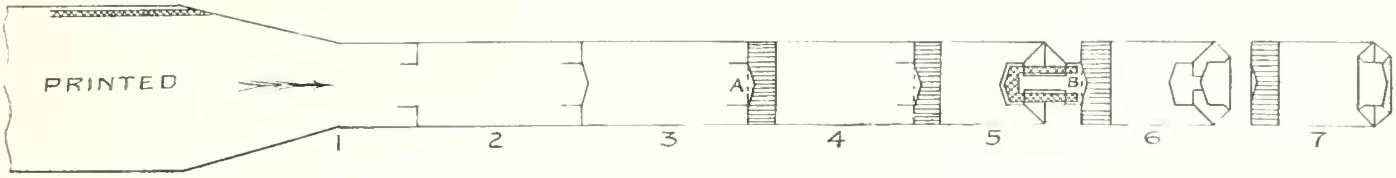
The various operations to produce the bags are as follows: The roll of paper is put on the compression arbor, which holds it in perfect alignment and tension. The paper is then passed through the rotary cylinder printing machine

which prints the continuous sheet with the design or label desired. This is done with electrotypes and the printing for both front and back of bag is done at once. The printed sheet is next run over the drying rolls to quickly dry the ink before entering the machine to be formed into bags.

bag when used. In connection with this pair of rolls, there is a blade and corresponding pocket that indents the paper at (A) Fig. 4, causing the lip to turn up slightly for the next operation of forming the diamond fold or open bottom of the bag as shown in Fig. 5. This is accomplished by means of a

is larger than the others, so that the printing will register evenly throughout the machine and not overlap.

From the inside of this roll, are operated by means of a continuous race cam and levers, a set of projecting fingers to force the paper free from the knives and to throw the flap which forms



PAPER BAG MACHINE—DIAGRAM OF BAGS IN PROCESS OF MANUFACTURE.

The first operation towards forming the bag consists in applying a strip of specially prepared and strong paste to one edge of the sheet which is to form the longitudinal seam on the back of the bag. This is acomplished by means of hard bronze rolls which carry the paste from a receptacle and deposit it on the edge of the sheet; the amount of paste being regulated to exact requirements. At this point, the regulating tension is applied to the sheet which keeps the paper smooth and even throughout the entire operation of forming the bag. The sheet next passes over the tube forming table in such a way that the sheet is formed into a flat tube. Fig. 1. by means of suitable guides, the edges to be pasted together are brought in contact, thus forming a complete and continuous flat tube ready for the further operations which are to quickly transform it into the completed bags.

The flattened tube now passes between a set of rolls that are provided with cutting knives and recesses on both sides. These cut the edges as shown in Fig. 2. This severs the tube except the central portion which serves to carry it through the succeeding operations. To the previously mentioned forming table, there is attached a long steel blade which extends inside the tube through the first pair of rolls to the centre of the second pair. This set of rolls engages the sides of the tube firmly, and carries a finely serrated toothed cutter bar to cut and form the outer flap of the bag bottom. This is accomplished by means of cam operated rolls which by a quick movement from beneath, force the blade inside the tube against the toothed knife above, sever the upper central part of the tube as shown at Fig. 3. This leaves sections of the tube to form the bags being entirely detached except for the central portion on either side or back of bag.

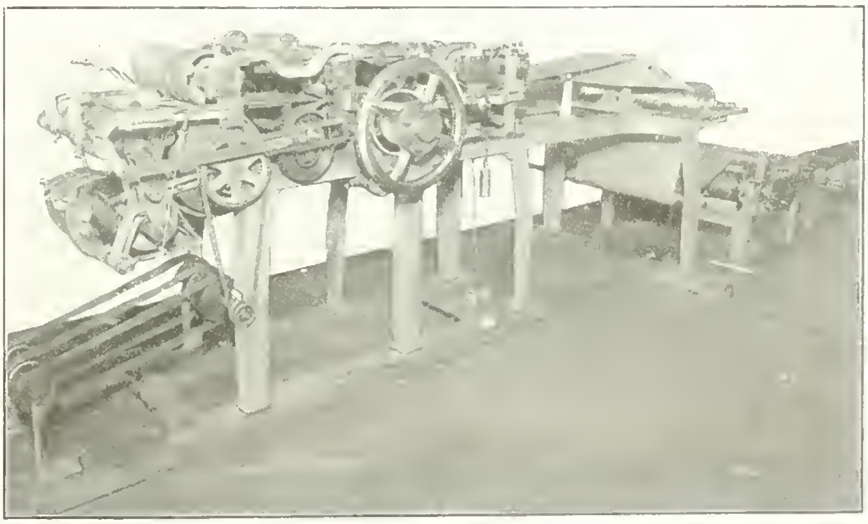
The tubes afterwards pass through a pair of grooved rolls which crimp and soften the short portion which is to form the top of the bag. This is done to facilitate the folding and tieing of the

peculiarly formed device which draws the end of the tube into the desired shape by means of a blade operated by a double beat cam of new design and is drawn under a wide flat blade attached to a tripper bracket. This tripper bracket is operated by an electro-magnet and is a new feature in this class of work. The flat tripper blade enters the tube under the lip (A), Fig. 4, and the flat blade draws the paper into the form shown in Fig. 5.

As the partly formed bag is drawn from the folding device, it passes through a pair of rolls where it receives the paste to hold the bottom when folded. This paste is applied by means of a bronze distributor of roll form which receives its supply of paste from a bronze roll running in a fount and driven by gearing to insure a continuous

the first fold of the bottom, Fig. 6, up into position to be properly engaged by the tucking fingers, and be then forced between the folding rollers which bear against the larger roll. This completes the folding of the first half of the bottom, as in Fig. 6. As the partly folded bottom emerges from the rolls, the former operation is practically repeated by the projecting fingers, and a second set of tucking fingers or blades which fold the last half of the bottom and force it between another set of rolls which compresses the whole bottom firmly together, and makes the paste adhere firmly to the paper. From this operation the bags pass the counter then to the table ready for stacking in piles to dry before bundling for shipping or storage. The complete folded bottom is shown in Fig. 7.

The machines which are clutch driven



PAPER BAG MAKING MACHINE

supply. The required amount of paste is regulated by wipers and distributed on the bottom as shown by the checked lines in Fig. 5.

The next operation is to sever the bags entirely from each other, which is done by sets of fluted knives contained in the 5th pair of rolls. This is shown at (B), Fig. 5. One of this set of rolls

and require but little power to operate, are built for T. Patterson & Son, 30 Mountain Ave., Hamilton, Ont., by Rae Bros. of Hamilton, Ont., who have made arrangements to build them separately or in sets as required. We understand that Messrs. Patterson contemplate putting the machines on the foreign market in the near future.

INDUSTRIAL NOTABILITIES--No. 17

WHEN people speak of the Nova Scotia Steel & Coal Co. they unconsciously suggest the name of Thomas Cantley, for the names of the general manager and the Steel Company are almost synonymous. To utter the name of Thomas Cantley is to call to mind the words Nova Scotia Steel Co., and vice versa.

He is a bold man. You can see it in his face. His life which follows in detail, proves it. One who can start life in a telegraph office as a messenger boy, run a hardware store, and gradually climb by sheer hard work to the head of a big steel corporation, must be bold. His start in life and his attainments remind one of Andrew Carnegie. The Laird of Skibo began in a telegraph office.

Boldness marked his utterances when the Canadian Manufacturers' Association met in Halifax last September. He grasped the opportunity to tell the men from Ontario that the East, and particularly the steel industry in the East, were not getting a square deal. It is safe to say that Government noted what this bold man said, and are still pondering over it.

Relating briefly how and where he began: He was born in New Glasgow, N.S., in the very town that now contains the immense steel plant of which he is the head. At 15 he was a telegraph messenger, and later an operator. At 16 he became a clerk in a hardware store, and remained in it four years. In 1885 he was appointed sales agent for the Nova Scotia Steel Co., and in 1898 was made assistant manager. To-day he is general manager and second vice-president.

THOMAS CANTLEY.

At various dates between 1895 and 1900, Mr. Cantley spent considerable time in Great Britain and Germany, in connection with the introduction and sale of Wabana iron ore in those countries, months being spent in and about the iron and steel works of the Westphalian District and the Silesian and other Northern Districts of Germany, with the result that this company, since that date has exported to and sold Germany more than two million tons of Wabana ore.

In 1899, Mr. Cantley was commissioned by his directors to proceed to London and open negotiations with the General Mining Association for the purchase of the famous "Old Sydney" coal deposits of Cape Breton. The following winter he was cruising the Mediterranean coal-receiving ports, Marseilles, Genoa, Naples, and the ports in the Adriatic, investigating the methods of discharge, storage, sale and consumption of bituminous coals in those ports, and the feasibility of supplying Southern Europe with bituminous coal in competition with British and American mines.

In 1909, 1910 and 1911 several visits were made to the United Kingdom, Germany and France, for the purpose of investigating at first hand, coal and ore mining and handling in the native mines of these countries, and studying first-hand the open-hearth making, including the investigating of the subject of fluid compression and the hydraulic forging of steel. The outcome of this was the installation of the works of the company at Sydney Mines of the first fluid steel compression plant in Canada, followed by the installation at New Glasgow of one of the most modern hydraulic forging plants in existence.

Mr. Cantley married Maria Fraser, Pictou, N.S., in 1883, and had three sons and two daughters, four of whom are still living. He is a member of the Iron and Steel Institute of Great Britain; of the American Institute of Mining Engineers; the West of Scotland Iron and Steel Institute, and the Electro-chemical Society; the Canadian Mining Institute, and the Nova Scotia Mining Society, also a member of the Halifax Club, Halifax, and the Scotia Club, New Glasgow. He is a Presbyterian, and a Conservative, and resides in the town where he was born—New Glasgow.

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Vol. XI. JANUARY 15, 1914 No. 3

PRINCIPAL CONTENTS.

ROTARY ENGINES.

WE had thought that the development of the steam turbine into the front rank of prime movers—call it a rotary engine if you like, would have had a somewhat dampening effect on inventive genius relative to what are distinctively known as rotary engines; in other words, the revolving piston type machine. There has, however, been little let-up, which goes to show what a fascination such a product seems to have for some people.

Like men and machines of a class generally, there is a striking similarity between all the piston type rotaries. Valuable time and hundreds of thousands of dollars have been expended in the quest for a piston type machine which will compass the work of the old-time, yet modernly designed reciprocating steam engine; and now that a rotary type machine —the steam turbine, has given evidence of its capacity, efficiency, economy, and reliability under the most severe and exacting service conditions, in spite of its complicated structure, and that the best brains of the civilized world in steam and mechanical engineering have failed to connect greater simplicity with reliable service, it only remains for those obsessed by the idea that they have a piston type rotary engine design in their head, which if put into material form would revolutionize the whole realm of prime movers, to lull it to sleep and tuck it away against a day when their work and worth will be less valuable to the engineering profession than it is now.

PROFIT-SHARING.

THE profit-sharing scheme announced by the Ford Motor Co., of Detroit, easily takes first place in the industrial records of the New Year, and may, on account of its uniqueness and prodigality, maintain pride of place for some considerable time to come. Taking all the circumstances into consideration, there is little prospect of a parallel to the scheme being found in any page of history relative to industrial enterprise.

In brief, $20,000,000 profits are reckoned as being assured for this present year, and of this amount, one half, or $10,000,000 is to be distributed among Ford employees. The plant will run throughout the full 24-hour day, on three operative shifts of 8 hours each, and all men over 22 years of age in the Company's employ will receive a minimum wage of $5.00 per shift of 8 hours, while those worth more will receive additional remuneration, according as their services warrant.

What will be the general impression formed of the scheme as launched and what will be the general effects, beneficial or otherwise, are matters that the lapse of a greater or lesser period of time can only determine, but meanwhile the opinion may be hazarded that employers generally, for good and sufficient reasons, will not be disposed to follow suit, even on a much reduced scale, and that employees engaged in a myriad trades and callings will be thrown into a state of unrest, which will take Father Time some traveling to soothe.

The Ford Company is largely in a class by itself, its plants being models of up-to-dateness in layout, equipment and system, whereby a high quality and world-popular product is manufactured on the most economical basis. As a result, enormous profits are being made, and what is perhaps the most impressive feature in connection with these profits is the fact that their accumulation is due to a moderate return per unit on a large output.

The desire expressed by the President, Mr. Henry Ford, that "other employers will recognize the unequal distribution of earnings and endeavor in their own way to make a better division" is a laudable one, yet, while there may be room in many cases where such action might be taken, and given publicity to, there is the inevitable outcome that large numbers of high principled employers, whose business success is nothing beyond a living for all in it, relatively, would be placed in a most undesirable position, not only in the eyes of their manufacturing associates, but in the good-will and esteem of their own and other firms' employees.

The Ford scheme when considered from the "high cost of living" viewpoint, pits steel against steel, and may not on this account meet with the approval of those whose desire is the lowering of the cost of the product, but whatever our views, the marvelous success of the Ford Company, and the boldness and extent of their 1914 workers' welfare propaganda must merit our admiration.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Mont'l.	Tor'to.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3....	20 00	21 50
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3.......	20 00	22 00
Clarence, No. 3........	20 50	21 00
Jarrow	.....	23 50
Glengarnock	......	26 00
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1........	19 40	18 35
Victoria, No. 2X	19 15	18 10
Victoria No. 2 Plain ..	18 90	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh.........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal......	2.10
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh.....	1.20
Steel hoops, Pittsburgh..........	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents..**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 40 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 65; malleable bushings, 65; nipples, 77½; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base..		$2 30
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOILER PLATES.

	Mont'l.	Tor'to.
Plates, ¼ in., 100 lbs...	$2 30	$2 20
Heads, per 100 lbs.......	2 55	2 55
Tank plates, 3-16 in......	2 60	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	9 00	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate Washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb off
Nuts, Hexagon, all sizes..	4½ per lb off
Fillister head	25 per cent.
Iron rivets	60, 10 p.c. off
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, bronze	70, 10, 7½, 10 p.c. off

Milled Products.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in...	75%
Finished Nuts over 1 in....	72%
Semi-Fin. Nuts up to 1 in..	72%
Semi-Fin. Nuts over 1 in...	72%
Studs.....................	65%

OLD MATERIAL.

Dealers' Buying Prices.	Mont'l.	Tor'to.
Copper, light	$10 00	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings..	9 00	9 00
No. 1 wrought iron.....	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	13 00	12 00
New brass clippings....	8 50	8 75
No. 1 brass turnings....	7 25	7 50
Heavy lead	3 75	4 00
Tea lead	3 00	3 00
Scrap zinc	3 00	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$. 32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	.....	...	.....
10 in	3.50	....	.....	...	.....
10 in	4.12	....	.....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect from April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in. ..	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Mont'l.	Tor'to.
Lake copper, carload...	$16 00	$16 50
Electrolytic copper	15 75	16 00
Casting copper	15 25	15 60
Spelter	5 25	5 25
Tin	38 50	40 00
Lead	5 00	5 25
Antimony	8 50	8 50
Aluminum	21 00	19 50

SHEETS.

	Mont'l.	Tor'to.
Sheets, black, No. 28........	$2.75	$2.70
Canada plates, ordinary, 52 sheets	2.75	2.75
Canada plates, all bright.	4.00	4.15
Apollo brand, 10¾ oz. (American)	4.30	4.20
Queen's Head, 28 B.W...G.	4.40	4.40
Fleur-de-Lis, 28 B.W.G.....	4.20	4.25
Gorbal's Best, No. 28......	4.40	4.40
Viking metal, No. 28......	4.40	4.40

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll....	0.95
Motor gasoline, single bbls., gal. ..	0.26
Benzine, per gal.	23½
Pure turpentine	0.60
Linseed oil, raw	0.60
Linseed oil, boiled	0.63
Plaster of Paris, per bbl.	2.10
Plumbers' Oakum, per 100 lbs. ..	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b. Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Jan. 12, 1914.—There is little to report this week, conditions remaining practically unchanged. A leading machinery house states that there will be a great rush of business as soon as money becomes a little easier. Many firms would be in the market for machinery now but for the lack of funds.

The Montreal Locomotive Works, Ltd., although they had a good year in 1913, when they built 318 locomotives, are very quiet at present. They have only two orders on hand, and have been compelled to reduce their staff to 760 men, whereas they employ about 2,000 men when business is brisk. However, rumor states that it is not improbable that this firm may shortly secure a very large order from the Canadian Northern Railway, who are also understood to be again in the market for a large number of freight cars.

The Canadian Car and Foundry Company's plants at Turcot and Dominion were closed down from December 24 till January 5; and, although both shops are now open, it is understood that they are only operating at about 50 per cent. capacity, except in the passenger car department. The company has on its books orders amounting to $3,500,000, but new orders are coming in very slowly. This refers more particularly to the freight car shops. The passenger car department is said to have enough work on hand to keep it busy till October next.

Although Montreal's water supply is once more normal in quantity, public opinion is still strongly exercised over the recent water famine. Work is being rushed on the installation of an emergency intake pipe connecting the pumping station with the Lachine Canal. The pipe will be 1,200 feet long by 6 feet diameter, and will only be used in an emergency, since the water drawn from the canal would naturally not be all that could be desired from a hygienic point of view. This new intake pipe is expected to cost about $50,000.

Metals.

The metal market remains dull, but prices show a slightly firmer tendency. In the steel trade it is likely that an improvement may be looked for in the immediate future, a rise in prices being probable in sympathy with the United States market. Reports to hand to-day from Pittsburg state that more than 50,000 men, who have been idle for from one to three months, will be re-employed by the end of this week in the Pittsburg district alone, where steel orders aggregating 125,000 tons are said to have been entered.

Toronto, Ont., Jan. 13, 1914.—Enquiries for steel for the first of the year are good. There is more confidence being shown, and before long orders should come in freely. There is a slight buying movement not noticed before, and the market is considerably stronger. Prices remain practically the same as last week.

For nuts, bolts, and screws, the demand is fair. Stocks carried by both the retailer and jobber are bare, and the minute the public gets confident, there will be a big demand. Prices remain constant. It is believed that these are as low as they can go. If there is any change it will be upward.

We quote plate washers this week. The discount—45 per cent. off—has gone up since November. The prices of nuts and bolts have not been affected much. The bolt business took a spurt forward two weeks ago, but taking of stock everywhere at Christmas caused it to slacken up again. Bolt and nut manufacturers are piling up stocks in the hope that a big demand will come from the West in March.

In the city, several engineering firms have recently received large contracts which will keep them running during the winter. The Massey-Harris Co. are very busy just now, much of their business coming from export orders. Implement firms in Hamilton are also increasing their staffs as winter progresses.

Factory Products, Ltd., who have two sides to their business—electrical supplies and steel—report a record year, and at present are not noticing the depression. Their business in electrical supplies for December, 1913, was over 40% in excess of that done in 1912.

Machine tools.

Enquiries for machine tools are fairly good considering the condition of trade. The only feature this week is the specification issued by the Electric Steel & Metals, Ltd., Welland, Ont., who have commenced the erection of one section of their plant. The Hull Iron Works, the new name of Coplan's, who moved their plant from Ottawa to Hull, Que., have purchased a full line of machine tools, valued at from $6,000 to $7,000. They also purchased considerable foundry equipment and electric motors.

There has been a radical change in machine tool agencies throughout Canada during the past few weeks.

The metal market is still asleep. Tin is a cent a lb. cheaper.

St. John, N.B., Jan. 9, 1914.—The improvement of conditions in financial circles is making its effect felt in St. John as well as elsewhere, and the result is shown in the announcement of new enterprises of more than local interest. In addition to announcements concerning plants such as the Ford Automobile Co., the Canada Wire and Nail Co., and others having established themselves in this city, come now new reports in which it is stated that another automobile concern will establish itself in St. John, as also a packing Company. The automobile Company referred to is the Dominion Motor ar Co., Ltd., which is to be capitalized at $400,000 in common and preferred accumulative 7 per cent. stock, $300,000 of which has already been paid up. John A. Graham, former general manager of the Maritime Motor Car Co., Ltd., which was absorbed recently by the Ford Motor Car Co. will be general manager of the new concern, with Leslie F. Bond

sales-manager and vice-president. The board of directors will not be chosen until a meeting is held, but it is fully expected that the president will be H. M. Kilburn, of the National Bank, New York City, with a board of directors comprising P. A. Rockefeller, J. H. Flagler and other well known American capitalists, two of them being prominent directors of an American automobile company capitalized at $10,000,000. Preliminary application for a charter has been made by S. M. Skinner of this city.

The company has leased from the Coldbrook Realty Co., a site adjacent to the Ford plant and, in the factory to be established, will construct a light six-cylinder 40-50 h.p. touring car from parts imported direct from England. It is later intended to manufacture the parts at Coldbrook where the site is located. Construction is to start within sixty days, and the plant is fully expected to be ready to begin operations by July 1. Mr. Graham, who will be general manager, said this week that this really meant the start of the introduction of American capital into Canada in larger amounts than heretofore for the promotion of industrial enterprise.

The New Brunswick Packing Co., recently organized, is now closing negotiations for a site in this city to establish a modern large sized meat packing plant. Stock will be raised in the Province for supply purposes. The St. John Desk Co., which has a factory there, has found it necessary to enlarge its plant, and is preparing to erect a new and up-to-date wood-working factory at Coldbrook to cope with its growing trade.

Leslie F. Bond, referred to in a foregoing paragraph in connection with the new automobile industry is planning the establishment of a plant for the manufacture of brick and crushed stone. Brick at the present time is being imported from Nova Scotia at a cost thought higher than necessary, because of the local yards being filled with orders. It is believed that abundance of material for the manufacture of bricks is to be had in the city, and a sample of clay will be sent next week to the C. W. Raymony Co., of Dayton, Ohio, to determine whether or not this is the case. If it be found satisfactory, the Raymony Co. will very likely locate in St. John adding another plant to their lengthy chain.

TRANSMISSION MACHINERY CONTRACT.

THE Chapman Double Ball Bearing Co., have recently secured the contract for the complete transmission equipment, including their ball bearing hangers, for the new Michigan Central Railway Shops at St. Thomas, Ont. This Chapman company has previously equipped the Grand Trunk Railway Co. shops at Stratford, the National Transcontinental Railway shops at Transcona, the Canadian Pacific Railway at West Toronto, North Bay, McAdam Junction and a section of the Angus shops, and the Intercolonial Railway shops at Moncton, N.B. and Riviere du Loup, Que.

Personal

A. E. Jenckes, head of the Jenckes Machine Co., St. Catharines, Ont., was elected an alderman at the recent municipal elections.

Elijah Eagle, foreman of one of the departments of the Preston Car & Coach Co., has resigned, and has gone into the lumber business at Cochrane.

Sir Sandford Fleming, the eminent Canadian scientist and engineer, celebrated his 88th birthday at Ottawa, on Wednesday, Jan. 7. He is enjoying good health.

Edward Lee, of the rail inspection staff of the Dominion Iron & Steel Co., Sydney, N.S., has gone to England for a trip, after which he will move to Pittsburg.

George P. Napier, C.E., has been appointed assistant engineer in the British Columbia Department of Public Works, to J. E. Griffith, Chief Engineer and Deputy Minister of the Department.

C. C. Cariss, chief draughtsman for the Leonard Engine Works, London, Ont., has been appointed instructor in mechanical drawing and shop mathematics for evening classes, at Ingersoll, Ont.

Charles D. Campbell, B.A., Sc., town engineer of Galt, Ont., and son of D. M. Campbell, manager of the Preston Car & Coach Co., was married to Miss Eve May Pickard, of Galt, last Thursday.

G. B. Green, general manager of the General Supply Co., Ltd., Ottawa, and C. R. Medland, manager of the Winnipeg branch, were in Toronto last week conferring with G. B. Harlock relative to business for 1914.

J. Frater Taylor, president of the Lake Superior Corporation, leaves early in February for the Old Country to have a conference with the corporation's financiers. On his return it is expected that work on additions to the plant will commence.

V. L. Upson, one of the promoters of the Dunville, Wellandport and Beamsville Electric Railway, has taken the position of general manager of the Buffalo and Jamestown Electric Railway. He says the D.W. and B. Railway will undoubtedly be built this year.

J. F. H. Wyse, consulting engineer, 34 Victoria Street, Toronto, has been appointed organizer and engineer of the Ontario Safety League. He has, for a number of years, been associated with the Ontario Railway and Municipal Board in a consulting capacity.

Charles F. Roland, Industrial Commissioner for Winnipeg, has returned from a visit to Great Britain, where he arranged for the financing of ten buildings for manufacturers. He has also arranged for a visit to this country of a number of prominent British business men.

William St. Clair, manager of the St. Clair Bros.' foundry, Galt, Ont., was presented with an engraved gold-headed umbrella on Friday, Jan. 2 by the employes. William Davies on behalf of his fellowworkmen read an address in which he referred to the good feeling existing between the manager and men. William Vrooman made the presentation.

John R. Freeman, who has been engaged as an expert to inquire into the water situation in Montreal, was born in 1855, and received his early training as an engineer with the Essex Company of Lawrence, Mass., of which the late Chas. J. Storrow, one of the earliest and most able of hydraulic engineers in America, was the executive head. After acting as consulting engineer to various manufacturing companies, Mr. Freeman opened an office in Boston.

A. M. Moseley, manager of the Page-Hersey pipe mills, Welland, was the guest at a banquet at the Welland Club on Saturday, January 3, prior to his departure for Fort William to take charge of the firm's new plant there. W. W. Near, president, was in the chair, and others present included: I. V. Mansel, assistant to the president; Jos. Moseley, manager of the Guelph plant; H. F. Lloyd, general manager of sales; H. Rook, secretary-treasurer, and Geo. Sauber, chief salesman. Mr. Moseley was presented with a club bag, bearing his initials. Several tributes were paid him by those present. Earlier in the day H. J. Foster, chief electrician, on behalf of the employees, presented the departing manager with a diamond ring. Mr. Moseley has been entrusted with the starting up of all the company's plants—at Guelph, Welland, and now of that at Fort William.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

St. John, N.B.—T. McAvity & Sons, Ltd., are preparing to call plans for the erection of their new plant.

Greenwood, B.C.—In a fire last week at the B. C. Copper Co.'s plant a 40 h.p. motor and a small crusher were destroyed.

Ottawa, Ont.—It is reported that the plant of the International Marine Signal Co. closed down indefinitely on January 5.

Wingham, Ont.—The Western Foundry Co., which closed down before Christmas, does not expect to start again for some weeks.

Toronto, Ont.—The Canada Foundry Co., who were reported to have closed down indefinitely, state that work will be resumed after stocktaking.

Cobourg, Ont.—The Car Works have re-opened, after being closed down for some time. Orders for cars which will keep the plant in operation for several months have been secured.

Dundas, Ont.—A fire in the storehouse and machine shop of the Canada Crushed Stone Co. on January 10 did damage amounting to about $20,000. The loss is pretty well covered by insurance.

Niagara Falls, Ont.—The Canadian Kennedy Mfg. and Engineering Co. was this week incorporated at Toronto, capital $400,000, to manufacture rock and ore crushers, mining and cement-making machinery, conveying apparatus, boilers, engines, mills, tools, hardware accessories and equipment, etc. Incorporators: Charles Hurphy, Harold Fisher, etc., Ottawa.

Victoriaville, Que.—The Begin Manufacturing Co., Ltd., recently incorporated with $49,000 capital, will establish an iron foundry here. G. Begin, of Windsor Mills, Que., is one of the incorporators.

Toronto, Ont.—The King street works of the Gurney Foundry Co., makers of stoves, which have been closed down for several weeks, resumed operations on Monday last. The plant at Toronto Junction has been running full time.

Derby Line, Que.—The Union Twist Drill Co., Derby Line, Vt., are preparing plans for the erection of a factory in the Quebec portion of the town of Derby Line. Frost & Chamberlain, Worcester, Mass., are their architects.

Sherbrooke, Que.—Mackinnon, Holmes Co., Ltd., bridge builders, have asked the city to guarantee their bonds to the extent of $40,000 to enable them to build a plant. The chairman of the Finance Committee opposes it.

Edmonton, Alta.—M. C. Murray, field superintendent of the Nakamun Oil and Asphalt Co. will establish a plant here for the manufacture of oil machinery. The only other plant in Canada is at Petrolea, Ont.

Hamilton, Ont.—The Willys-Overland Automobile Co., a United States firm with headquarters at Toledo, Ohio, are incorporating in Canada with a capital of $500,000, and will begin active operations to manufacture automobiles at Hamilton.

Woodstock, Ont.—The ratepayers have agreed to lend $20,000 to the Woodstock Wind Motor Co., Ltd., for the consolidation of this plant with the Mitchell Concrete Machine Co., Toronto; the main plant to be built in Woodstock. Isaac L. Mitchell, owner; Thomas Watson, manager, Woodstock.

Bradford, Ont.—Watson, Limited, Toronto, makers of wire screening, etc., have built a plant here, and are now moving the old machinery in. No new machinery has been purchased yet. Operations on present lines are to be extended. The Company was known in Toronto as the Watson-Smith Co.

Toronto, Ont. — Sir William Mackenzie, president of the C.N.R., on his return from a trip over his transcontinental line last week, announced that the shops to be erected at Leaside, near Toronto, will be the largest on the system. The company will spend $10,000,000 on rolling stock, much of which has already been ordered in Ontario.

Deseronto, Ont.—After putting their new blast furnace at Parry Sound in operation last September, the Standard Iron Co., Ltd., makers of charcoal pig iron, reconstructed the Deseronto fur-

EQUIPMENT REQUIREMENTS

The Electric Steel & Metals Co., Welland, Ont., will be in the market during the next 30 or 60 days, for new or second-hand Machines as follows:—

1 Grinding Mill, 7 ft. dia. overdriven; 1/8-inch perforated plates; output about 3 tons per hour.

1 24 inch double grinder, with one wheel 24 inches x 3 inches and other 24 inch x 1½ inches; for dry grinding.

2 18 inch Single Grinders, 18 inches x 2½ inches wheel; for dry grinding.

1 Double Spindle Grinder, fitted with two emery rollers, 2 inches dia. x 6 inches long.

2 4-ft. Smiths Hearths.

1 Fan for Smiths Hearths, Belt Driven.

1 Belt Driven 160 lb. Hammer, 18 in. stroke; forge up to 6 inches.

1 Slotting Machine 8 inches stroke, to admit about 42 inches dia. and 13½ inches depth; traverse of table about 18 inches x 15 inches.

1 Radial Drilling Machine, about 4 ft. 6 inches arm; 2½ inches spindle; 14 feet feed; 12 inches raise and lower of arm; bed, 6 feet x 3 feet x 2 feet 3 inches.

1 Pillar Drilling Machine to admit about 30 inches dia. 2¼ inches spindle; 9 inches feed; 22 inches dia. table.

1 Saw Sharpening Machine, to sharpen saws from 6 inches to 36 inches dia. Belt Driven.

2 Hack Saw Machines, belt driven, to cut 8 inches x 8 inches; 18 inch blade.

1 Tool Grinder with one dry stone 12 inches x 1½ inches and one wet stone 12 inches x 1 inch; on stand.

Woodworking Machinery.

1 Planing machine with countershaft to take up to 15 inches wide, and 1-16 inch to 9 inches thick.

1 Circular Saw about 30 inches dia. 4 feet 4 inches x 2 feet 3 inches table, rising and falling.

1 Boring machine, for boring up to 7 inches deep.

1 Hand mortising machine, taking timber up to 16 inches x 7 inches.

1 Trimming machine, 8 inch stroke, taking up to 4¾ inch thick, table 20 inch x 8 inch.

nace, which is now in operation, at a cost of $60,000. The stack has been rebuilt and enlarged, increasing its daily capacity to 125 tons of pig iron; new stoves have been installed, and minor improvements made.

Toronto, Ont.—Canadian Copper and Armour Plate Co., Ltd., were recently incorporated at Toronto, with capital of $1,000,000, to carry on the business of foundrymen and metal manufacturers; to manufacture, treat and smelt ores and metals of all kinds; to manufacture and deal in articles, tools, machinery, and articles, the manufacture of which involves the use of copper, aluminum, or other metals. Incorporators: James F. Uffen, Emma Sandusky, etc., Toronto.

Victoria, B.C. Yarrow & Co., Glasgow, shipbuilders, who have purchased the shipyards of the B.C. Marine Railway Co. at Esquimalt, including a slip capable of docking vessels up to 300 feet, etc., announce that they will build additions as business increases. At present repairs to vessels and machinery will be undertaken. Mr. Keay, of the Glasgow plant, will reside here for three years, after which Mr. Norman Yarrow and Mr. Izard will take charge. The Government dry dock will be built at Lang Cove, which is quite near.

Gananoque, Ont. — The Gananoque Spring & Axle Co., Ltd., one of the branches of the Ontario Steel Products Co., a merger of several spring and axle companies in Ontario, started up their new plant here last week, built to replace that destroyed by fire in October. The plant is much larger than the old one, and was built by Anglins, Ltd., in a little over two months. The steel work used in the new building was furnished by the United States Steel Products Co., and fabricated by the International Marine Signal Co., of Ottawa.

Sydney, N.S.—With reference to the new heating furnace being installed in their rolling mill by the Dominion Iron & Steel Co., we are advised that this is an ordinary inclined furnace for heating steel ingots, no special machinery being needed in connection with its installation, nor will it be used for treatment of any new kind of steel. In the ordinary course of operations a certain number of ingots have to be set aside, and hitherto these have been reheated in the soaking pits in connection with the blooming mills. As the company's production of steel has considerably increased, it has been found inconvenient to continue this practice, and the new furnace has been installed to take care of the cold ingots, and relieve the soaking pits of this tonnage.

Electrical

Paris, Ont.—Hydro-Electric power was turned on in Paris for the first time on Jan. 8.

Neepawa, Sask.—The ratepayers recently voted $18,000 for the erection of an electric power plant.

Brantford, Ont.—Hydro-Electric power will be utilized for pumping the water at the local waterworks plant.

Coaticook, Que.—The town will spend about $1,500 on a line to Dixville for supplying power and light.

Brantford, Ont.—Hydro-electric power will be turned on for street lighting and domestic lighting on February 1

Stouffville, Ont.—The town will purchase and improve the electric light plant. The latter will cost $5,000, and $2,000 will be spent on improvements.

Banff, Alta.—The Government will spend $100,000 on the establishment of a hydro-electric plant, the power to be generated at Minniewanka Lake.

Ottawa, Ont.—The Minister of Railways has approved the plan of the Cedar Rapids Power Company for its proposed transmission line from the Rapids to Cornwall.

Hamilton, Ont. — W. C. Hawkins, managing director of the Dominion Power and Transmission Co., believes construction work on the new steam power plant will commence in March.

Guelph, Ont.—A Company composed of local men has been formed for the manufacture of tungsten lamps. A plant with an output of 1,000 lamps per day will be built. Ald. J. E. Carter is a director.

St. Catharines, Ont.—The Niagara, St. Catharones and Toronto Railway is erecting a power house on Welland Ave., 40 x 35 feet, costing $45,000. The Canadian General Electric Co. is supplying the equipment.

Winnipeg, Man.—Permission to the Winnipeg civic light and power department to do a light and power business in the municipality of Rockwood was granted by the Rockwood Council at its last regular meeting.

Vancouver, B.C.—The Daily Reduction Co., of Hedley, B.C., has accepted the plans drawn by A. J. Matheson of Cartwright, Matheson & Co., of this city for a power dam across the Similkameen river at Hedley. The dam, which will be over 200 feet long, will develop a horse power capacity of 18,000.

Brandon, Man.—A transmission line from Winnipeg to Brandon and Portage la Prairie could be built it is estimated for $500,000. These two towns contemplate taking power from Winnipeg. A committee has been appointed to secure data.

Yarmouth, N.S.—The special committee recommends that a contract be given to the Northern Electric & Mfg. Co., of Montreal, for apparatus, etc., for a 3 circuit system, compressed air plant, 60 cycle, 3-phase, 220 volt circuit air compressors, motors, etc., at $2,000; battery switchboard, etc., at $1,587; wire, labor, etc., at $425.

London, Ont.—The remaining equipment necessary for the furnishing of hydro power to operate the street railway system has been shipped from Montreal, and will be completely installed by the end of February. The Company is using only part hydro at the present time, but after March 1 will be using it exclusively.

Quebec, Que.—The Provincial Waterways Commission, of which the Hon. S. N. Parent is president, has completed its report. It is understood that the Commission favors the harnessing of the St. Maurice River in the vicinity of Le Tuque by the building of a dam, which will make possible the development of 500,000 horse-power for industrial purposes.

Calgary, Alta.—The Eau Claire & Bow River Lumber Co., First Avenue, W., are reported to be considering a plan for developing power to the extent of 1,500 k.w. The cost of the development will be about $300,000, and will probably involve the installation of two gas driven units and two turbo-generators. It is proposed to start work upon this development in the spring of 1914.

Berlin, Ont.—Several rural districts in North Waterloo have made a request to the Hydro-Electric Commission for information as to the cost of obtaining hydro power. They were quoted as follows:—For St. Jacobs, 50 horse-power would cost $29.04; for Conestogo, 50 horse-power would cost $36.59; for St. Clements, 50 horse-power would cost $42.68; for Floradale, 40 horse-power would cost $51.57. All the points named will, if taken, be served by the Berlin-Elmira hydro line.

Refrigeration

Victoria, B.C.— The Swift Canadian Co. have completed a new $200,000 branch here. The refrigerating machinery, of 35 tons capacity, was installed by Huetteman & Cramer, Detroit.

Concerning the Keeping of Cast Iron Wheel Records*

By H. H. Vaughan**

This paper describes the methods now adopted by a leading railway for keeping track of the life and behavior of chilled cast iron car wheels. The statistics compiled give the general results obtained from a given batch of wheels, no attempt being made to obtain individual records.

PRACTICALLY all railroads have abandoned any form of cast iron wheel record which follows the history of each individual wheel. Apart from the enromous amount of work in reporting and entering the movements of several hundred thousand wheels which are in service in a large system, it is practically impossible to avoid incorrect numbers being reported.

The difficulty of straightening out the errors that arise, errors which frequently were not disclosed for years after they actually occurred, and the correspondence involved in the attempt, were sufficient reasons for discarding a system that did not furnish sufficient useful information to justify its expense. The writer has not investigated methods used on other roads to describe them with accuracy in this paper, but believes that apart from the records maintained for guarantee purposes, the only systems in general use are those in which the average life of wheels removed from service for various causes, is determined in various ways. It is usual to show a figure for the average life of wheels obtained by dividing the number in service by the number removed per year, but this figure is not of much value as it depends more on the rate at which the number of wheels in service increases, than on the actual life of the wheels removed. Thus if a number of wheels in service remained stationary for a period of years, while the number of wheels removed increased 25 per cent., it would indicate a decrease in the average life of the wheels of 20 per cent., while if during the same period the wheels in service had increased 50 per cent., the same increase in the number of wheels removed would indicate an increase in the average life of 20 per cent.

Now if the increase in the wheels in service had taken place in two or three years, it would have had comparatively little influence on the wheels removed, so that an increase in the life of the wheel might be shown by these figures, while a reduction had actually occurred. In addition reports of wheels removed on foreign lines are not obtained correctly, especially for wheels removed on handling-companies' account and in general it is not uncommon for a life of twelve to eighteen years to be shown for wheels, when as a matter of fact they are lasting about five or six.

Method of Obtaining Records.

The figures showing the life of the actual wheels removed can be obtained with considerable accuracy and with simple reports and records. Each wheel is marked with its number, the date cast, etc., so that no complications are introduced by recording the date put into service and the date removed. While no record is usually kept of any time the wheel may be out of service, or the movements of the car under which it has been placed, these factors are relatively unimportant on a large number of wheels, and the average life of the wheels removed is a figure of sufficient importance on any road to justify the records and statements required. It should properly be kept by weight of wheels, so that any alteration that occurs in the life of wheels under the same weight of equipment may be distinguished from the changes due to the introduction of a greater proportion of heavier equipment or similar causes.

While the average life of wheels removed affords valuable information over a period of years, it does not enable the result of any variation in the quality or service of the wheels to be detected until considerable time has elapsed, and then only in a general way. When the wheel foundry methods of the Canadian Pacific Railway were revised in 1908, it became desirable to introduce some system by which it could be determined whether better service results were be-

*Extract from a paper read before the Canadian Railway Club, Montreal.
**Asst. to Vice-President, Canadian Pacific Railway, Montreal.

CANADIAN PACIFIC RAILWAY COMPANY

CAR DEPARTMENT

RECORD OF SERVICE GIVEN BY C.P.R. 600-LBS., 33-INCH "CAST IRON WHEELS," "A & B" SERIES

Year Cast, 1902. Number of Wheels, 30288. Serial Numbers: A 84889-106990. B 1-8177

Year	Worn Flange			Slid Flat			Broken or Chipped Flange			Broken Wheel			Total Operating Defects			Total Manufacturers' Defects			Removed from Tenders			Total Number Removed		
	Number	Percent	Total Percent	Number	Percent	Total Percent	Number	Percent	Total Percent	Number	Percent	Total Percent	Number	Percent	Total Percent	Number	Percent	Total Percent	Number	Percent	Total Percent	Number	Percent	Total Percent
1902	6	0.02	0.02	149	0.49	0.49	8	0.03	0.03				163	0.54	0.54	14	0.04	0.04	118	0.39	0.39	295	0.97	0.97
1903	139	0.46	0.48	503	1.66	2.15	38	0.13	0.16				699	2.31	2.85	332	1.09	1.13	814	2.69	3.08	1845	6.09	7 06
1904	362	1.20	1.68	535	1.77	3.92	41	0.14	0.30				958	3.17	6.02	670	2.21	3.34	264	0.87	3 95	1892	6.25	13 31
1905	915	3.02	4.70	408	1.35	5.27	36	0.12	0.42				1382	4.56	10.58	780	2.58	5.92	82	0.27	4.22	2244	7.41	20.72
1906	1081	3.57	8.27	254	0.84	6.11	21	0.07	0.49				1391	4 59	15.17	816	2.70	8.62	21	0.07	4.29	2228	7.36	28.08
1907	961	3.17	11.44	231	0.76	6.87	46	0.15	0.64				1262	4.16	19.33	676	2.23	10.85	17	0.06	4.35	1955	6.45	34.53
1908	771	2.55	13.99	159	0.52	7.39	21	0.07	0.71				983	3.25	22.58	734	2.42	13.27	12	0.04	4.39	1729	5.71	40.24
1909	641	2.12	16.11	100	0.33	7.72	15	0.05	0.76				785	2.59	25.17	539	1.78	15.05	12	0.04	4.43	1336	4.41	44.65
1910	465	1.53	17.64	88	0.29	8.01	10	0.03	0.79	3	0.01	0.01	579	1.91	27.08	413	1.36	16.41	2	0.01	4.44	994	3.28	47.93
1911	223	0.74	18.38	39	0.13	8.14	7	0.02	0.81	2	0.01	0.02	289	0.95	28.03	294	0.97	17.38	1		4.44	584	1.93	49.86
1912	138	0.45	18.83	30	0.10	8.24			0.81			0.02	175	0.58	28.61	188	0.62	18.00	1		4.44	364	1.20	51.06

FIG. 1. CONCERNING THE KEEPING OF CAST IRON WHEEL RECORDS.

ing obtained or not, without the complications of the old individual records.

This was accomplished in a satisfactory and simple manner by comparing for each year's make of wheels, of the same weight and manufacture, the number removed for various classes of defect in each year of their life. This system is shown in Figure 1—which gives the results for 600-lb. wheels cost by the Canadian Pacific Railway in 1902, the first year for which this statement was prepared. Similar statements have been made up for the same weight of wheel with its subsequent modification to 645 lbs. and 625 lbs. up to 1912, one of the manufacturers and operating defects, is broadly affected by the quality of wheels turned out, so that the statement, Figure 2, is a record of the foundry output in this respect.

This statement shows several interesting features. There is evidently a decided variation in the percentage of the

STATEMENT OF C.P.R. 600# & 645# WHEELS REMOVED EXCEPT ACCOUNT OF WORN FLANGES SLID FLAT AND TENDERS

Year Cast	No. of Wheels Cast	% Rem. 1st Year	% Rem. 2nd Year	% Rem. 3rd Year	% Rem. 4th Year	% Rem. 5th Year	% Rem. 6th Year	% Rem. 7th Year	% Rem. 8th Year	% Rem. 9th Year	% Rem. 10th Year	% Rem. 11th Year	% Rem. 12th Year	
1912	15384	.06												645#
1911	42105	.04	.25											"
1910	35710	.04	.27	.85										"
1909	53390	.03	.38	1.11	2.28									"
1908	36165	.11	.56	1.09	1.98	3.16								600 & 645#
1907	66730	.30	1.52	3.69	5.85	8.78	12.03							" "
1906	63819	.13	1.05	2.36	4.37	6.19	8.39	10.76						" "
1905	49239	.13	.83	2.40	4.53	7.10	8.98	11.01	13.50					600#
1904	32852	.07	.67	1.60	2.84	4.94	7.18	8.62	9.92	10.99				"
1903	35108	.16	1.38	3.45	5.84	8.16	10.96	13.61	15.29	16.54	17.33			"
1902	30288	.07	1.29	2.64	6.33	9.09	11.47	13.96	15.79	17.19	18.19	18.81		"
1901	27749	.16	1.10	3.45	6.30	9.15	11.92	14.1	16.6	19.0	20.38	21.60	22.78	"

FIG. 2. CONCERNING THE KEEPING OF CAST IRON WHEEL RECORDS.

does not require any additional reports over those commonly used. The only information needed is the make of the wheel, weight, date cast, maker and cause of removal, items that are likely to be reported accurately and which are those required for a record of any kind. As the number of wheels of any group cast in each year are known, the number removed in each year's life for each cause may be expressed as a percentage of the number made, and this percentage may be compared year by year to determine the comparative service obtained from the different wheels.

As the records are compiled in the Canadian Pacific Railway, no attention is paid to the date the wheel is put into service. For wheels made in any one year, the number removed in that year are taken as being removed in the first year of their life, those removed in the next year, as in the second year of their life, and so on. This introduces an inaccuracy in the case of any particular wheels placed in service towards the end of the year, but the error becomes unimportant after a year or so, and the labor of compiling the record is greatly reduced.

The statement obtained by this system advantages of this system being that with the records that had been kept it was possible without too much work to go back as many years as necessary to compare the results with those of previous years.

This statement, Figure 1—while giving all the information that is obtained for the wheels it refers to, does not enable any comparison to be made easily, and for that purpose a series of such statements for wheels made in successive years are combined as shown in Figure 2. This statement shows the number of the wheels of the weight it relates to made in each year, and the percentage removed in each year of their life for all causes, except worn flange, slid flat and removed from tenders. A similar statement, Figure 3, shows the percentage removed each year for worn flange, and slid flat and a similar statement, Figure 4, shows the percentage of broken wheels and broken and chipped flanges for the same series. It is evident that similar statements may easily be prepared for any cause of removal it is desired to investigate, but those shown are the ones that have been considered important. The elimination of wheels slid flat, worn flanges and removed from tenders, leaves a balance, that while not corresponding to the classification of wheels removed of different years' make, and it is only reasonable to suppose that where a larger percentage is removed in a given time, say, six or seven years, the life of the wheel is less. If this be granted, some years' makes are evidently considerably superior to others; for instance, those made in 1904 were far better than the average, while those made since 1908 have been uniformly good.

If all wheels made were accounted for, there would, of course, be no assumption involved, but by an inspection of Figure 1 it will be seen that of the wheels made in 1902, only 51 per cent. have been accounted for in 1912. It is improbable that 49 per cent. are still in service, and the difference is, therefore, to be accounted for by wheels placed under foreign cars or removed on foreign roads and not reported. This discrepancy might be reduced if the number of wheels of any make placed under foreign cars were deducted from the number made before calculating the percentage, but it would introduce a complication of doubtful advantages. The chief effect of this factor is in comparing wheels received under new cars

with those made or purchased for renewals. The former will evidently not be placed under foreign equipment to the same extent, but as this number has been under 10 per cent. of the total number placed in service each year its effect can be allowed for.

The reliability of the statement as a whole is confirmed by the fact that since 1908 it shows a decreased percentage of wheels removed, and that the average life of the wheels removed has since that time increased as follows:

Year.	Manufacturers' Defects.	Operating Defects.	Total.
1908	5 Years 2 Months	4 Years 5 Months	4 Years 8 Months
1909	5 " 2 "	4 " 7 "	4 " 9 "
1910	5 " 7 "	4 " 9 "	5 " 0 "
1911	5 " 4 "	4 " 9 "	4 " 11 "
1912	5 " 9 "	5 " 0 "	5 " 4 "
1913	5 " 11 "	5 " 5 "	5 " 7 "

An important point in this statement is the general agreement of the results shown throughout the life of any series of wheels with those shown in the first year or two. It appears almost certain that if the wheels are of good quality and carefully inspected that there will be less poor wheels to fail in the first year or so, and this result will persist throughout their life. This result is certainly true in the case of 1904 and 1908 wheels, and if it is confirmed by further experience, this form of statement furnishes a simple method of determining within a comparatively short time the service that may be expected from any group of wheels without the necessity for complicated records.

Figures 3 and 4 are also interesting statements. Wheels slid flat and worn flanges are not chargeable against the foundry, but they may be largely affected by the shops. Careless taping and mating, cars down on side bearings and sundry other causes for worn flanges, are all avoidable, and results may be followed by means of this report. Slid flat wheels are also caused by improper maintenance and operation and may be largely reduced by care.

It will be seen from this statement that there is comparatively little difference between the wheels removed for being slid flat of the various years' make. There is, however, a most decided difference in the number removed for worn flange, the wheels made in 1906 being considerably better than those of previous years, while there is a still greater reduction in 1908. The percentage of 1908 wheels removed in five years from this cause is only about 40 per cent. of the number removed in an equal time of the 1906 wheels and less than 20 per cent. of the corresponding number for the wheels made in 1903, 1904, and 1905. In 1908 the method of taping was carefully gone into and the work carried on with greater care, so it would appear that the proper carrying out of this work is most important to avoid injury to wheels from worn flanges. To the end of the fourth year the 1909 wheels are even better, so that the 1908 results were not simply accidental, but the consequence of greater care and better methods.

Figure 4, showing broken and chipped flanges and broken wheels, is also instructive. Unfortunately no distribution is made between broken and chipped flanges, but two facts are certainly shown. The most important is that broken and chipped flanges have been greatly reduced since 1908, and since there seems no reason for any change in the chipped flanges, it is to be hoped that the broken flanges have been largely eliminated. The second is that broken wheels are a most unimportant factor, the number rarely amounting to

C. P. R. WHEELS REMOVED ON ACCOUNT OF WORN FLANGE AND SLID FLATS.

Year Cast	No. of Wheels Cast	1st Year		2nd Year		3rd Year		4th Year		5th Year		6th Year		7th Year		8th Year		9th Year		10th Year		
		W F	S F	W F	S F	W F	S F	W F	S F	W F	S F	W F	S F	W F	S F	W F	S F	W F	S F	W F	S F	
1912	15384	.07	.62																			645#
1911	42105	.01	.26	.04	1.50																	"
1910	35710	.01	.21	.07	1.95	.16	3.33															"
1909	53390	.01	.47	.05	2.25	.14	4.05	.36	5.47													"
1908	36165	.02	.53	.10	2.31	.33	3.83	.71	5.13	1.42	6.09											600 & 645#
1907	66730	.02	.56	.20	2.41	.84	4.84	1.97	6.52	3.70	8.19	5.67	9.44									" "
1906	63819	.03	.73	.19	3.52	.81	6.13	2.34	8.53	4.39	9.98	6.43	11.27	8.29	12.16							" "
1905	49239	.04	.60	.42	2.67	1.89	4.72	4.28	6.39	7.69	7.97	10.79	8.99	13.41	9.64	15.32	10.14					600#
1904	32852	.06	.27	.40	2.57	2.01	4.58	5.44	6.35	9.36	7.74	13.87	8.88	17.36	9.49	19.86	9.81	21.30	10.0			"
1903	35108	.03	.33	.44	1.99	2.46	3.61	6.01	4.93	9.84	5.80	13.31	6.64	16.40	7.35	18.51	7.70	19.72	7.96	20.55	8.13	"

C. P. R. WHEELS REMOVED ON ACCOUNT OF BROKEN FLANGE OR WHEEL.

Year Cast	No. of Wheels Cast	1st Year		2nd Year		3rd Year		4th Year		5th Year		6th Year		7th Year		8th Year		9th Year		10th Year		
		B F	B W	B F	B W	B F	B W	B F	B W	B F	B W	B F	B W	B F	B W	B F	B W	B F	B W	B F	B W	
1912	15384	.02																				600 & 645#
1911	42105	.01		.04	.002																	
1910	35710	.01		.04		.07																
1909	53390	.01		.06	.003	.10		.19	.005													
1908	36165	.02		.08		.14		.21	.005	.28	.02											
1907	66730	.07		.18		.34		.53	.005	.68	.01	.85	.02									
1906	63819	.05		.37		.61		.87		1.13	.005	1.33		1.52	.011							
1905	49239	.03		.17		.46		.65		.80		1.04	.004	1.19	.01	1.31	.016					
1904	32852	.04		.12		.29		.48		.62		.71		.82	.003	.87		.93				
1903	35108	.03		.16		.29		.46		.64		.77		.87		.96	.003	1.04	.006	1.11		
1902	30288	.03		.16		.30		.42		.49		.64		.71		.76		.79	.01	.81	.02	
1901	27749	.02		.11		.19		.31		.46		.54		.63		.67		.70		.76		
1900	31060	.02		.13		.29		.40		.53		.61		.67		.74		.79		.83		

FIGS. 3 AND 4. CONCERNING THE KEEPING OF CAST IRON WHEEL RECORDS.
W. F., S. F., B. F. and B. W. Signify "Worn Flange," "Slid Flat," "Broken Flange" and "Broken Wheel" Respectively.

one-tenth of 1 per cent. in ten years. These facts are of the greatest interest as showing the excellent service that may be obtained from a well-made chilled wheel.

Figures 5, 6, 7 show similar statements for the wheels supplied by three separate manufacturers, giving the same information for the same weight of wheel as Figures(2, 3 and 4. It will be seen in Figure 5 the 1907 wheels from manufacturer "A" compare very closely with the 1908 C.P.R. wheels on the percentage removed for foundry causes, but that for the balance of the groups of wheels, poorer results are shown. In Figure 6 the removal of wheels for worn flanges from manufacturer "B" is exceedingly small, while the number removed from other manufacturers compare with the later C.P.R. results. Wheels from manufacturers "B" and "C" were received under new cars, so that it would appear that in the case of "B" particular care was taken with the taping. In Figure 7 there is a peculiar circumstance. The broken and chipped flanges from manufacturer "A" were about equal to the earlier C.P.R. wheels, and greater in number than from the C.P.R. wheels made after 1907. Those from manufacturer "C" are closely the same as from C.P.R. 1908 and 1909 wheels, but there are practically no broken flanges and no broken wheels from manufacturer "B". This question is being investigated, but without any reason being so far obtained.

Reference has been made throughout this paper to the revision of the Canadian Pacific foundry methods in 1908 and to the results obtained since that date, which evidently show a considerable improvement. Prior to that date the mixture had been handled by brands and numbers, and, as the records show, in some years very good wheels were made, and in others the results were not as good.

In the years 1906 and 1907 considerable trouble arose, a large number of failures occurring in service, caused, as was subsequently discovered, chiefly by iron of widely varying silicon content, but of the same brand being used indiscriminately. The system of inspection was not sufficiently thorough to reject all wheels of improper quality, and while the records in use at that time did not indicate anything unusual, sufficient trouble developed in service to draw attention to the irregularity in the wheels.

Mr. Ira B. Lesh was engaged to organize the manufacture on a basis in which the mixtures would be accurately determined by chemical analysis and the inspection effective to reject any of the product that was not of the proper quality. A proper mixture is, of course, only one of the factors entering into the manufacture of a satisfactory wheel, and considerable attention was paid to other points as well, with the results that obvious defects disappeared, while the records show that a permanent improvement was obtained.

C.P.R. Practice.

It is not the intention to make this paper one of the manufacture of chilled cast-iron wheels, but in view of the enormous importance of the subject, it is interesting to describe the lines on which the Canadian Pacific practice has been developed and discuss the opportunities for improvement.

The writer considers one of the most important factors in obtaining good wheels is that of inspection. Absolutely uniform and perfect foundry practice is, of course, the great thing to obtain and the most difficult, but that is the portion of the subject which would be better described by some competent wheel manufacturer. Inspection should detect those wheels which for any reason depart from the accepted quality, and for this purpose the wheels to be tested should be selected with care and sufficient wheels broken from any day's run to ensure the rejection of any that are either too hard or too soft.

MANUFACTURE. A.

Year Cast	No. of Wheels Cast	% Rem. 1st. Year	% Rem. 2nd. Year	% Rem. 3rd Year	% Rem. 4th Year	% Rem. 5th Year	% Rem. 6th Year	% Rem. 7th Year	% Rem. 8th Year	% Rem. 9th Year	% Rem. 10th Year	% Rem. 11th Year	% Rem. 12th Year	
1912	24975	.04												645#
1911	19527	.05	.47											"
1910	8950	.08	.53	1.51										"
1909	8614	.14	.60	1.49	2.62									"
1908	23018	.04	.61	1.38	2.92	4.54								"
1907	14000	.04	.35	1.02	1.98	3.20	4.61							600#
1906	1800	.16	.55	1.05	3.00	4.11	5.61	6.78						"
MANUFACTURE. B.														
1907	4000		.22	1.90	4.32	7.36	11.36							600#
MANUFACTURE. C.														
1907	4000	.10	1.12	2.60	4.48	6.23	10.21							600#

FIG. 5. CONCERNING THE KEEPING OF CAST IRON WHEEL RECORDS.

This may be accomplished by comparing the tapes and chill tests and rejecting all soft and hard wheels until it can be determined within reasonable limits that the wheels accepted are the good. Inspection should, of course, detect all ordinary defects, but it can be carried on to properly protect the content to prevent the constant increment in sulphur which occurs from remelting with coke, but refers to the value of charcoal iron as against coke irons. Good results have certainly been obtained from the latter if properly handled, but on the other hand, if any advantage in strength can be shown for certainly appear that a light chill is a cause of weakness not only in the tread under heavy loads, but in the flanges. This may be explained by the structure being that of a hard rigid surface joined to a softer and less rigid back. Grey iron, while often considered as a rigid material, has only about 50 per cent. to

MANUFACTURE. A.

Year Cast	No. of Wheels Cast	1st Year W.F.	1st Year S.F.	2nd Year W.F.	2nd Year S.F.	3rd Year W.F.	3rd Year S.F.	4th Year W.F.	4th Year S.F.	5th Year W.F.	5th Year S.F.	6th Year W.F.	6th Year S.F.	7th Year W.F.	7th Year S.F.	8th Year W.F.	8th Year S.F.	9th Year W.F.	9th Year S.F.	10th Year W.F.	10th Year S.F.	
1912	24975	.03	.11																			625 & 645#
1911	19527	.03	.28	.12	1.46																	645#
1910	8950	—	.39	.10	1.97	.41	5.27															"
1909	8614	—	.37	.07	1.47	.26	3.28	.70	4.70													"
1908	23018	.02	.19	.08	2.07	.20	3.59	.66	5.03	1.46	6.02											"
1907	14000	.04	.31	.14	1.59	.43	2.98	1.20	4.32	2.29	5.13	3.66	5.82									600#
1906	1800		.78	.17	1.50	.34	2.22	1.12	3.44	1.90	4.44	2.96	4.82	3.35	5.26							"
								MANUFACTURE B														
1907	4000		.05		.90	.02	3.13	.10	5.53	.52	6.55	1.79	7.73									600#
								MANUFACTURE C														
1907	4000		.05	.02	.68	.02	2.15	.52	4.10	.87	5.32	2.34	6.77									600#

FIG. 6. CONCERNING THE KEEPING OF CAST IRON WHEEL RECORDS.
W. F. and S. F. Signify "Worn Flange" and "Slid Flat," Respectively.

heat, and this is most important. One thing should be remembered, that out of the ordinary lot of wheels, 60 per cent. will run through their life and be removed without any defect that reduces the life of the wheel, so that it looks very much as though the question of getting the other 40 per cent. out of the way by better practice or improved inspection were the important ones.

Mixtures.

The question of mixtures is a very vexed one. Prior to 1908 charcoal iron was extensively used on the Canadian Pacific Railway, and the trouble that occurred was caused by its improper use and not on account of its quality. Since that time its use was abandoned for about two years, and it has subsequently employed to the extent of ten or fifteen per cent. of the mixture. In spite of the great reputation of charcoal iron, it is a question to what extent it can be better than coke iron after being melted up in a cupola heated by coke. This statement is not intended to refer to the use of iron with a low sulphur charcoal iron the additional cost is not worth considering. The great question at the present time is that of improving the quality of the chilled wheel. It has only one serious point of weakness, the danger of broken flanges. The records show that the number of broken flanges has been greatly reduced since 1908. If this is correct, the causes are, the reinforced flange, careful manufacture, good inspection and a rather hard wheel.

The reinforced flange was introduced in 1906-7 when the 600-lb. wheel was changed to 645 lbs., and it would appear that this change made a great improvement.

Depth of Chill.

The Canadian Pacific Railway practice has during the past few years run to a hard wheel, the rule being to use the M.C.B. limits for depth of chill, applying them to the pure white iron only. This was introduced on account of an investigation made on a number of wheels causing derailments on account of broken flanges, which showed that the majority were soft wheels, having 3/8 inch or less depth of chill. It would 60 per cent. of the rigidity of the white iron, which probably corresponds closely to that of hardened steel. When this compound structure is subjected to any force, placing a tensile strain on the surface, this strain is largely localized on the layer of white iron, the grey iron beneath it taking less than its share on account of its greater elasticity. It is, therefore, necessary to maintain a sufficient depth of white iron to resist a force of this nature, which is that brought on the flange by the rail, and it is evident that the white iron is greatly assisted when backed up by a large amount of grey iron, which is the case when the flange is reinforced, as in the latter designs of wheels. This is probably the correct explanation of the greater amount of flange breakage with soft wheels, and it is apparently confirmed by the results that have been obtained.

There is good ground for expecting that the use of the reinforced flange and better knowledge of the causes governing the strength of white iron may lead to considerably better results being ob-

tained from the chilled wheel in the future.

On light equipment with less severe brake service than is usual to-day, the chilled wheel has given excellent results and is even now most economical and satisfactory in most respects. Flanges practically never break through the line in which they are restricted in strength, and until they do so, there is every reason to hope that the cast wheel may be able to hold its own, and in time to render the good service it has in the past.

SHOULD CHILLED CAR WHEELS BE ANNEALED ALL OVER?

IN a discussion following a paper read recently before the Canadian Railway Club at Montreal on the subject of "Cast Iron Wheel Records," the question was brought up of how best to strengthen chilled wheels in view of the ever-increasing loads imposed upon them by modern traffic conditions. Mr. E. B. Tilt, Engineer of Tests, Canadian Pacific Railway, remarked that at the Angus shops of that road test bars, 2 inches in diameter, had been cast with a chill extending right through them. These bars were tested, without being annealed, on a small drop-testing machine, and were found to have a strength superior to that found in the flange metal of car wheels cast from the same mixture and at the same time. The wheels had, of course, been annealed in the usual way before being tested, and that fact, the speaker stated, seemed to suggest that the life of chilled wheels might perhaps be prolonged if some means could be devised by which the grey iron portion of the wheel could be annealed, leaving the tread and flange in the same condition as when the wheel left the mold.

Such a method of annealing wheels has, of course, been adopted by foundrymen when a few wheels have been wanted in a hurry. In such a case, the plate of the wheel is covered up with sand as soon as it is removed from the mold, thus causing it to cool as slowly as possible, and so relieving the internal strains. While no detrimental effect has been observed from this rough-and-ready method of annealing, it is not known how the life of the wheel has been affected thereby, no records having been kept, but in view of the results on test bars obtained by the C.P.R., it would seem worth while following up the question more closely. The quality of the cast iron chilled wheel has improved to a very marked extent during the last ten years, especially in Canada; but if this wheel is to retain its place in railroad work it will have to be still further improved to meet the exacting conditions demanded by modern heavy traffic.

CANADA'S TRADE INCREASED.

THE trade of Canada during 1913 increased by $210,000,000 over 1912. This is the greatest increase in one year over a previous year ever recorded in the history of the Dominion. The total figures for 1913 are $1,085,264,449; of this, $686,604,413 was imports and $337,068,355 exports. The duty collected amounted to $114,501,670, being nearly $30,000,000 more than before.

Trade with France increased by $4,000,000, the increase being largely in imports, although half a million dollars worth of goods more than in 1912 was shipped to France. The total trade was slightly over $17,000,000.

Trade with Germany did not increase so much as did that with France. The increase was a little less than $3,000,000. The total trade done was $17,876,227, of which no less than $14,500,000 was imports and less than $3,500,000 exports.

Trade with Great Britain increased by over $48,500,000. The exports to Great Britain increased more than the imports from there. The imports were $139,646,356, a gain of nearly $22,500,000, while the exports amounted to $117,982,002, an increase of over $26,500,000.

Canada does nearly double the trade with the United States that she does with Great Britain. The United States trade amounted to $622,432,937 in 1913. This was nearly $137,000,000 over 1912.

MANUFACTURE A.

Year Cast	No. of Wheels Cast	1st Yr.		2nd Yr.		3rd Yr.		4th Yr.		5th Yr.		6th Yr.		7th Yr.		8th Yr.		9th Yr.		10th Yr.		
		B.F.	B.W.	B.F.	B.W.	B.F.	B.W.	B.F.	B.W	B.F.	B.W.	B.F.	B.W.	B.F.	B.W.	B.F.	B.W.	B.F.	B.W.	B.F.	B.W.	
1912	24975	.02																				645#
1911	19527	.02		.07	.01																	"
1910	8950	.03		.18		.26	.01															"
1909	8614	.03		.23		.42		.58														"
1908	23018	.03		.11		.19		.32		.42												"
1907	14000	.01		.11		.17		.31		.38		.42										600#
1906	1800	.11		.17		.34		.40		.46		.57		.68								"
								MANUFACTURE B.														
1907	4000									.02		.02										600#
								MANUFACTURE C.														
1907	4000			.08		.16		.21		.29		.31	.05									600#

FIG. 7. CONCERNING THE KEEPING OF CAST IRON WHEEL RECORDS.
B. F. and B. W. Signify "Broken Flange" and "Broken Wheel," Respectively.

Canadian General Electric Co. Ltd. 25th Anniversary

What follows constitutes the address given by Mr. Frederic Nicholls, President of the Canadian General Electric Co., at a meeting of Directors held on December 27, last, to commemorate the 25th anniversary of the organization of a syndicate to enquire into the feasibility of establishing in Toronto a system of incandescent electric lighting. The same syndicate subsequently organized the Canadian General Electric Co., Ltd.

MR. NICHOLLS in the opening sentence said: To-day is the twenty-fifth anniversary of the inception of the enterprise which later developed into the Canadian General Electric Co., Ltd. On the 27th of December, 1888, I called together a number of gentlemen then, as now, prominent citizens of Toronto, with a reputation as successful and public-spirited business men. They then affixed their signatures to a simple letter agreement to join me in a syndicate to provide a fund to defray the expenses of inquiring into the feasibility of establishing in Toronto an electric plant to supply electric light and power by means of underground wires. At that time I little thought of the tremendous development that lay before us.

At the meeting were present, besides myself as organizer, Messrs. W. R. Brock, W. D. Matthews, J. K. Kerr, Geo. A. Cox, Robert Jaffray, Hugh Ryan, and H. P. Dwight. Mr. Hugh Ryan and Mr. H. P. Dwight continued their association with us until death removed them, and to-day we can point to the unique record of six out of eight of the original directors who are still acting in that capacity, after an unbroken period of a quarter of a century.

Continuous Record of Success.

Twenty-five years ago our assets consisted of our capital of $10,000.00, ten of us having subscribed a sum of $1,000 each; to-day our assets are in the neighborhood of $25,000,000, or a steady growth and development at an average rate of $1,000,000 a year for twenty-five years in succession, and, as the chief officer of your company, I may be pardoned if on this special occasion I draw attention, with some little personal pride, to the fact that a dividend has been earned and paid in each and every year since our organization.

As a result of having had the good fortune or prescience to associate myself in the beginning with such able men as have formed our directorate, we have been able to so conservatively conduct our operations that, in addition to having paid out no less a sum than $6,286,744 in dividends during the past twenty years, a surplus nearly equal to 40 per cent. of the paid-up capital, both common and preferred, has been accumulated.

Gratifying Facts and Figures.

When I refer to the conservative and cautious policy that has been followed by the directorate, it is perhaps as well that I should substantiate this statement by facts:

1.—There is absolutely no "water" in the capitalization of the company, every share, both common and preferred, having been sold for cash at par or better, and the average cash received by the company has been $118 per share sold. This, I claim, is unique in the annals of Canadian industrials.

2.—We have sufficient cash and current assets to pay off every dollar of indebtedness, also the entire issue of preferred stock, and still leave nearly $50 in net quick assets for every share of common stock, in addition to all the capital assets.

3.—Notwithstanding the fact that the value of the real estate, buildings, and machinery owned by the company is greatly in excess of the values as they appear on our books, and, after deducting $1,100,000 reserved for depreciation, there remains $95 in capital assets for every share of common stock, so that the common stock represents a value of $140 a share.

4.—The company has created no bond or mortgage indebtedness, and consequently has no fixed charges, its liability in this respect being limited to having assumed from time to time the outstanding obligations of enterprises that have been acquired by purchase or consolidation with the parent company.

5.—Dividends paid to shareholders ($6,286,744), added to reserves accumulated from undivided profits, total a sum in excess of our total paid-up capital stock, both common and preferred, of ten million dollars. Our capital five years ago was $6,700,000.

Company Stock in Favor.

Some years since, when the growth of the company assumed such proportions that it was considered advisable to interest English and foreign capital, an issue of capital stock was placed on the London market. Since that time the British investor has absorbed more and more of the company's share capital, until to-day we have some three thousand shareholders, with an average holding of about twenty-seven shares of common stock, and, as one thousand of our three thousand shareholders are women, it would seem that our shares are favorably considered from a purely investment standpoint.

Toronto Incandescent E. L. Co.

The first company to be organized by the syndicate was the Toronto Incandescent Electric Light Co., on the 26th day of June, 1889, the intervening time since the organization of the syndicate having been occupied in negotiating an agreement with the Edison Electric Light Co., of New York, for the exclusive use of their system, and, by prolonged negotiations with the City of Toronto, for a franchise to generate electric light and power, and distribute the same by underground conductors. Mr. W. D. Matthews was elected president, Mr. H. P. Dwight and myself vice-presidents, and Mr. J. K. Kerr, solicitor, our bankers being the Imperial Bank of Canada. This company was very successful, and was subsequently amalgamated with the Toronto Electric Light Company.

Toronto Construction and Electrical Supply Co.

Our next venture was the Toronto Construction and Electrical Supply Company, which was incorporated on the 11th of February, 1891. Mr. W. R. Brock was elected president; Mr. H. P. Dwight and myself vice-presidents; Mr. J. K. Kerr, solicitor, and the Canadian Bank of Commerce, bankers for the company. This company was the parent of the Canadian General Electric Co. The officers remained unchanged until last year, when, after the death of Mr. Dwight, I was elected president to succeed Mr. Brock, who had accepted the office of honorary president and chairman of the board, and Messrs. W. D. Matthews and the Hon. J. K. Kerr, K.C., were elected vice-presidents. The Hon. J. K. Kerr, K.C., is still our solicitor, and the Canadian Bank of Commerce is still one of our bankers.

The business of the Toronto Construction & Electrical Supply Co., was the sale of electrical apparatus and supplies, and soon after its incorporation, on the 14th of October, 1891, it formed an alliance with the Thomson-Houston Electric Co., of Boston, and entered into an agreement to act as their sole agents for Canada. From the start we were very successful, and secured in a short time such favorable recognition from the purchasing public that negotiations were entered into for the purchase of all the Canadian property and interests of the Edison Electric Light Co., including their

factory at Peterborough, the Thomson-Houston and Edison interests in the United States having in the meantime been merged into the General Electric Company.

Canadian General Electric Co. Organized

After some delay in the negotiations, an agreement of purchase was concluded, and the Canadian General Electric Company was organized on the 5th of September, 1892, so that the Canadian General Electric Company, which was the outcome of the original investment of $10,000 by the syndicate of ten, has some time since attained its majority.

At the time of the formation of the Canadian General Electric Company, the capital assets consisted solely of the land and buildings at Peterborough, whereas to-day we own ten manufacturing establishments, the head office, and six branch office buildings. The factories comprise: The main Electrical Works at Peterborough; the Electric Porcelain Works at Peterborough; the Canada Foundry Works at Toronto; the Architectural Bronze and Iron Works at Toronto; the Electric Supply Works, Toronto; the Canadian Sunbeam Lamp Works, Toronto; the Bridge and Structural Steel Works at Bridgeburg, Ontario; the Canadian Allis-Chalmers Works at Montreal; the Tungsten Electric Lamp Works at Montreal; and the Flour Mill Machinery Works at Stratford, Ontario.

Branch Offices Feature.

At the inception of the company, the only branch offices were in leased buildings in Montreal, Winnipeg, and Vancouver, whereas to-day our branches are in Halifax, Montreal, Ottawa, Cobalt, Porcupine, Sudbury, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Prince Rupert, Vancouver, and Victoria, which enable us to cover the entire field of Canadian enterprise. In the more important centres, the buildings occupied are owned by the company, and have been constructed to suit our own requirements. Each district has an adequate staff, and carries a stock of merchandise suitable to the needs of our local customers.

C. G. E. Development.

At the time we purchased the Canadian property of the General Electric Company, we also acquired the exclusive rights of the Edison Company, the Thomson-Houston Company, the Fort Wayne Electric Company, and the Brush Electric Company, and since then have from time to time acquired the Canadian business and good-will of many other companies that have enabled us to extend our field of operation, including amongst others:

The Ball Electric Light Co......	1892
The Peterborough Carbon Co....	1895
The Electric Storage Battery Co.	1898
The Canada Foundry Co........	1900
The Royal Electric Co..........	1900
The Stanley Electric Co........	1900
The Northey Steam Pump Co...	1902
The Sunbeam Electric Lamp Co..	1912
The Tungstolier Company	1912
The Canadian Holophane Co.....	1912
The Allis-Chalmers Mfg. Co.....	1913
The Stratford Mill Building Co..	1913

In May, 1901, the company purchased a valuable water power development, four miles from the Peterborough Works where our electric power for operating has since been generated, and in 1910 we secured a twenty-year leasehold from the Town of Peterborough of a part of their waterworks dam, where we have developed an additional 1,000 horse-power.

Our first head office was at 63 Front street West, Toronto, where only a few employees were required until, as the business grew, we had to secure more commodious quarters, and removed to 14 and 16 King street east, which we leased for a term of years. Outgrowing this building in turn, we, in 1908, removed to our present head office building, built by the company for our own special requirements.

The Future Outlook.

Having briefly reviewed our past history, I would like to say a word as to future prospects. I do not desire to pose as a prophet, for the reason that our own future must run parallel to the future development of our country.

Personally, I have the utmost faith in the future development and continued prosperity of Canada. Occasional setbacks we must expect, but the march of progress must be always onward, as so much of our great country still remains to be developed and populated. Next year, two new transcontinental railways, the Canadian Northern and the Grand Trunk Pacific, will be in operation for the first time, operating through trains from the Atlantic to the Pacific. The Canadian Pacific Railway have increased their trackage, rolling stock, and other facilities, at an expenditure equal to that required to build a new railway from ocean to ocean. The contracts for the new Welland Ship Canal have been let by the Dominion Government. Public works of great magnitude are either under construction or being projected by the Federal and Provincial Governments. Up to the present our immigration has continued to increase, so that, taking it all in all, the future is full of promise, even though for some short while we may experience a recession in trade, as a result of the present world-wide financial uncertainty.

Mr. F. A. Vanderlip, president of the National City Bank of New York, an authority on financial and trade statistics, in a recent address, made the statement that the intelligent development of the electrical industry in the United States will readily absorb for the next five years, $400,000,000 a year, or $8,000,000 a week.

Steam Railway Electrification.

I do not predict that in Canada our percentage of trade, on a pro rata population basis, will be so startling, but there is no reason why we should not expect a satisfactory growth in the demand for our products. A normal growth of population may be counted on. The trunk line railways will undoubtedly electrify certain sections, such as terminals and mountainous divisions, and I am pleased to say that the first two important contracts that have been let for the electrification of steam railways in Canada have been awarded to this company. I refer to the electrification of the Rossland-Castlegar division of the Canadian Pacific Railway in the Rocky Mountains, and the electrification of the tunnel under Mount Royal, and the Montreal Terminal for the Canadian Northern Railway.

In considering the future uses of electricity in Canada, we must have in mind the impetus this industry has received as a result of the utilization of our magnificent water powers. Few realize that from Quebec in the East, to Victoria, British Columbia, in the West, nearly every city, town and village has the advantage of hydro-electric power for its lighting, its street railways, and its industries. Quebec, Montreal, Ottawa, Toronto, London, Port Arthur, Fort William, Winnipeg, Calgary, Vancouver, Victoria, and intermediate points, are all operating electrically, and our reserves of water powers undeveloped will serve the needs of the country beyond our time.

C.G.E. Directors.

W. R. Brock, Hon. President and Chairman of the Board.
Frederic Nicholls, President.
W. D. Matthews, Vice-President.
Hon. J. K. Kerr, K.C., Vice-President.
Sir William Mortimer Clark, LL.D., K.C., Director.
Hon. Geo. A. Cox, Director.
A. E. Dyment, Director.
Sir Rodolphe Forget, Director.
H. S. Holt, Director.
Hon. Robert Jaffray, Director.
Sir William MacKenzie, Director.
F. G. Osler, Director.
J. K. L. Ross, Director.

THE MANUFACTURE OF MODERN METAL FILAMENT LAMPS.

IN the Zeitschr. des Ver. deutsch Ingen of October 11, 1913, Mr. Otto Ruff describes the principal stages in the preparation of the metallic filaments for incandescent lamps, including the production and working of the tungsten rods, the drawing of the wire therefrom and the manipulation required in the making of lamps out of the wire. The author first points out the advantages of this type of lamp, since the tungsten filament is much more refractory than the carbon filament, and gives a better luminous effect. The metallic tungsten is generally obtained in the form of a fine powder which is difficult to compress, and when it is successfully compressed, the metal obtained is not sufficiently ductile to permit of being drawn out; hence the preparation of the filaments presents considerable difficulties. In order to transform the tungsten powder, which must be very pure, into a sufficiently flexible and resistant filament, the following procedure is adopted:—

The metallic powder is first strongly compressed in a steel mold, and a very fragile rod is produced which must be made stronger by reheating. This operation is carried on in a tubular furnace, in which the rod is first heated gradually to a red heat, then to a temperature higher than that employed in the chemical preparation of tungsten powder. The whole operation is carried out in a current of hydrogen. The rods are next sintered by exposure to a temperature of 2,850 deg. cent. in an electric furnace, on leaving which they have a coarsely crystalline appearance. During this sintering process the metal contracts to the extent of 14 per cent.

The resistance of the rod is now such that it may be drawn out either by hammering or rolling, and this operation is generally effected by means of a special rapid hammering machine at a temperature of about 1,300 deg. Cent. When the diameter of the rod has been reduced to about three-fourths of a millimetre, the ductility of the metal is sufficient to allow it to be cold drawn. It is preferable, however, to do this with special heated draw-plates, by means of which the diameter is reduced to one-fortieth of a millimetre. Before being mounted in the lamp, it is again reheated in a current of hydrogen to remove a thin coating of oxide.

CANAL HOSPITAL SERVICE.

CONDITIONS approaching those of a well equipped army will prevail in connection with the building of a new Welland Ship Canal. Dr. McCoombs is in charge of the hospital and medical service which the Government is instituting, and says:—

"The main hospital will be on the Havens farm on the Queenston and Grimsby road. This will be thoroughly equipped, and capable of providing accommodation for thirty patients, with small separate places for men suffering from infectious diseases. There will be a thoroughly competent staff of nurses and doctors, as well as good office and clerical staff. At Thorold, we shall have a small branch hospital for about ten patients. This will be used as an emergency hospital, in case of bad accidents. There will be another such branch hospital at Fort Weller.

"Along the line of the canal, dispensaries will be located, where the men who are sick will receive medicine. Three doctors will be constantly patrolling the canal, so that there will be no lack of attention. An ambulance will be established and small stretchers will be in every camp. It is my intention to have the clerks and timekeepers on the canal thoroughly drilled in first aid work. Each will have a medical and surgical case and be taught how to handle it. We shall give a prize of $50 every six months to the man who proves most efficient."

CANADIAN HARBOR WORKS.

TENDERS received on January 9 for harbor works at Victoria, B.C., costing about $3,000,000, round off the list of extensive harbor improvement inaugurated by the Government in all parts of the country. Every port of any importance now has under way works calculated to vastly increase the transportation facilities of the country. The total cost, when all are completed, will probably be around $75,000,000.

Halifax is getting modern ocean terminals for the Intercolonial Railway, and a large dry dock is to be built. St. John has the Courtney Bay improvements, and another dry dock. Quebec has under way large docks and dredging contracts, while at Levis the biggest dry dock in the world is under way. The St. Lawrence channel is being deepened to Montreal, where the port improvements scheme, when completed, will have cost eighteen million dollars.

Toronto harbor works will entail another ten million. At Hamilton, Sault Ste. Marie, Port Arthur, and Fort William similar undertakings are well advanced. Winnipeg is getting navigation by the Red River. On the coast, the Vancouver docks will cost upwards of six millions.

In addition to the Victoria harbor works, the site is selected for a dry dock to duplicate that at Quebec.

CONCERNING LEATHER BELTS.

LEATHER belts, states the Light Car and Cyclecar, differ from the rubber kind inasmuch as they require some form of dressing in order to keep them soft and pliable. Seeing that belts on motor vehicles are almost invariably completely exposed to the attacks of the elements, a leather belt is more troublesome than a rubber one, as it is more affected by such attacks. Mud and gritty particles become embedded in leather, but rubber seems to repel matter of this kind, probably because it is more elastic. A leather belt should be periodically scraped on its driving side, and the best way to know when this operation is required is to examine the belt. If it shows signs of becoming glazed on the driving side it should be scraped with an old knife. Care should be taken to use the knife sparingly so as not to remove anything more than the grit. The belt should then be dressed, with oil.

BERLIN BOARD OF TRADE.

THE annual meeting of the Berlin Board of Trade was held on January 8, there being a large representative attendance. President Breithaupt, in his annual report, stated that Berlin's growth during 1913 was most gratifying. Three new industries were secured, which will employ at least five hundred hands. While the year has been marked by money stringency, there has not been a single failure reported in Berlin. He predicted that the city would reach a population of twenty thousand during 1914. Secretary Clement reported a membership of 270, being an increase of 20. Steps were taken to urge the City Council to appoint an industrial commissioner, and also to petition the Railway Commission to order the G.T.R. to move its shunting-yards to another section of the city.

The officers elected were—President, L. J. Breithaupt; vice-president, W. M. O. Lochead; secretary, W. P. Clement; treasurer, W. A. Schmalz. Council H. J. Sims, D. B. Detweiler, Dr. Rudell, G. M. Sherk, W. H. Leesson, W. G. Cleghorn, A. Foster, Sr., W. E. Gallagher, H. L. Jansen, Dr. Walters, E. W. Lamprey, N. B. Detweiler, G. M. Debus, S. Wellheiser, E. Smyth.

Montreal, Que.—The warehouse of Frothingham & Workman, hardware merchants, St. Paul street, Montreal, was totally gutted by fire on Jan. 13. The firm's books and papers were saved, but the damage done to stock was $200,000, all of which is covered by insurance.

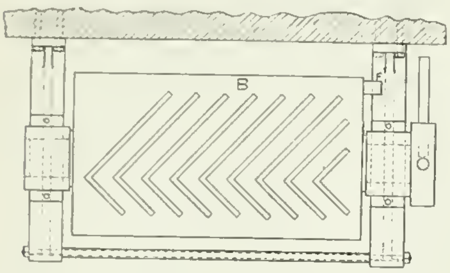
MACHINE SHOP METHODS AND DEVICES

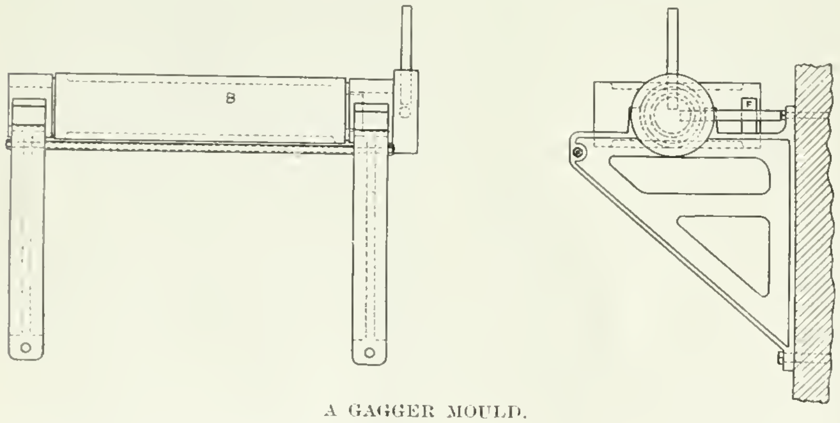
Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

A GAGGER MOLD.

By D. O. Barrett.

MAKING gaggers is in most foundries a troublesome operation and is put off by the molder as long as possible, he meanwhile helping himself to his neighbor's stock. The mold shown in the drawings was arranged in a large foundry near the cupola, and bolted to the wall. It consisted of a large solid, cast-iron block (B) planed both sides to facilitate levelling and with a bearing turned on each end. The block was arranged for gaggers on one side, and for certain sizes of arbors on the other, large numbers of which were used in making cylinder cores. The bearings were slightly off centre so that the weight would come on that side and cause the block to always remain in a horizontal position resting on the foot (F) which, in turn, rested on the top of the supporting bracket. Two brackets supported





A GAGGER MOULD.

the block and were bolted solidly to the wall, being spaced at the outer end by the piece of pipe with a tie rod through same.

Two molders worked the arrangement, one pouring and one turning the mold. As fast as one side was filled, the block was turned over by means of the cold rolled steel handles in the collar at the end of one of the bearings. The foot (F) striking the bracket would jar out any of the castings which had a tendency to remain in the mold. When that side was full, it was again reversed. The pouring operation was almost continuous while it lasted, and, needless to say, it did not take long to make up a stock.

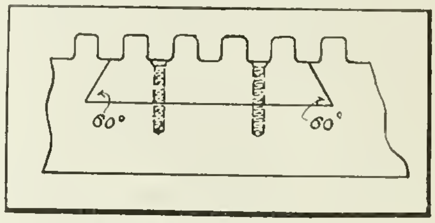
The block could be watercooled, but this was not necessary as it took a long time for the block to become hot enough to be objectionable. This was the main reason for making the block so heavy. After being used for some months no warping was detected.

MENDING A LATHE RACK.

By N. G. Near.

NOT many years ago when employed in a machine shop out West, one of the men very carelessly threw in the screw cutting clutch and feed screw simultaneously. You know just about what would happen provided the feed belt drive didn't slip. Well, the belt didn't slip, and the weakest part, of course, broke—the rack teeth were stripped. The foreman reprimanded the lathe operator rather severely, and the lathe operator grew "sassy," the outcome of the whole mess being that the man was fired.

The foreman then started worrying about the rack. He had it taken off, and was on the point of ordering a new one when I chanced to ask him if it wouldn't be possible to repair it at less expense than to buy a new one. He doubted it, but told me to go ahead and see what I could do with it. In less than an hour I had a block dovetailed into the rack as shown, most of the work being done with grindsones and files. The 60-degree angles were obtained by use of triangular files. I then laid off the teeth as accurately as I could with a scratch awl, took the block out, and filed the teeth to a very carefully made template. Two screws, as shown, made the job complete, but these were scarcely necessary inasmuch as they did not have to withstand any thrust when the lathe was



MENDING A LATHE RACK.

in use, and inasmuch as my fit was pretty tight anyway, I just put them in as a matter of safety.

It is true that the teeth I filed were not as accurate as the others that had been cut by cutters made for the purpose, still, the rack is still in service and doing good work. As far as I can see it is not absolutely essential that the teeth in a rack like this be perfect except for the sake of lessening the tendency to wear.

The foreman was much pleased with my effort because the lathe was laid up only a couple of hours, whereas, had he ordered a new rack, it would have been laid up for some days.

MAKING GAS ENGINE CAMS.

By D. S. Mann.

MANY gas engine builders make their cams either from steel castings or from drop forgings, finishing same all over by milling or grinding. Many cams are cast very close to size, and then disk ground to get the edge square with the face. In automobile practice, the cams and shafts are drop forged integral with each other, and, after being turned and milled, are hardened and then ground to size. These refinements are, however, not necessary in the ordinary farm engine, and the writer wishes to give two methods of making cams for this style of engine. Where cams are fitted to shafts by means of keys, very careful fitting is necessary as the pressure comes first on the one side and then the other, and, should the least looseness occur, the keys are gradually pounded out of shape and the cam comes loose. For this reason, cams are usually pinned as well as keyed where this method is employed. Fig. 1 shows a detail drawing of a cast iron cam and its shaft for a small gaso-

line engine of $1\frac{1}{2}$ horse power. The cam is cast directly on the shaft, a one-quarter inch pin being driven in on the one side to act as a driving key. As the

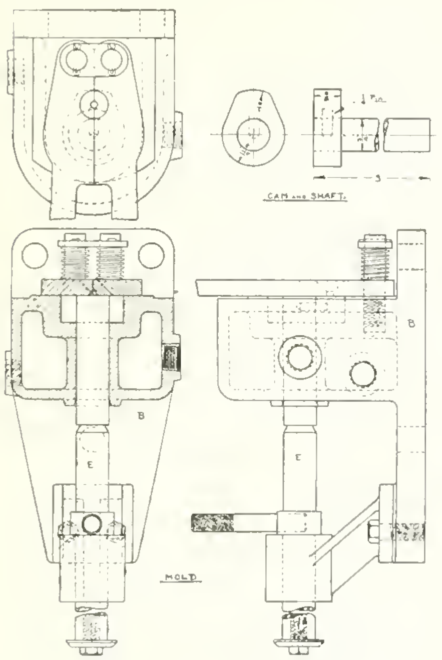


FIG. 1. MAKING GAS ENGINE CAMS.

metal contracts in cooling, it will grip the shaft.

The mold in which these cams are cast is shown in the three views. The body, (B), is a steel casting, being machined out at the upper face to the shape of the cam. A cam shaft is shown in position in the mold, resting on the ejector (E). The body is cored out so that water may be circulated through to aid in keeping cool. Two steel plates are arranged to close over the top of the mold and are extended out to form handles, a clevis being riveted to the one handle, and, by slipping over the other handle, they are held together while pouring. A hole is provided over the mold for a pouring gate. The pivot pins have heavy springs to force down these plates and keep them in proper contact with the top of the mold. At the lower end of the main casting is a bracket carrying the ejector rod (E) which is in line with the cam shaft. This rod is provided with a knurled handle so that it may be raised up, thereby knocking out the cam and shaft. A washer is fastened to the lower end to limit its movement. A shoulder on the rod (E) rests on the top of the lower bearing, and the rod is of such a length that the cam shaft when dropped in comes just flush with the top of the mold.

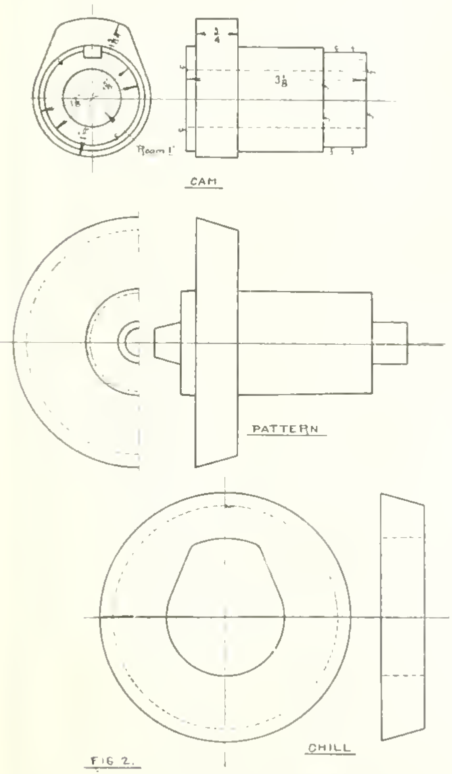


FIG. 2. MAKING GAS ENGINE CAMS.

The mold was bolted to the wall of the foundry near the cupola and piped for the running water. It was operated by two men, one doing the pouring and the other dropping in the shafts and ejecting the castings. The inside of the mold was kept well coated with graphite. The iron set very quickly, and the cams could be knocked out almost immediately after pouring. No further work was done on the castings with the exception of grinding off the gate.

In Fig. 2 is shown a cam of a different type, this one revolving on a stationary shaft. The cam is cast with a hub on either side, the long hub being turned down on the end to receive the driving gear. The other end is merely faced off after the hole is reamed. The pattern is fitted with a print as shown, and when lifted out of the sand, the chill is dropped in. It is seen that the cam is only chilled on its working edge. The cams come out of the chills exceedingly smooth and no grinding is necessary except perhaps to take off a fin at the edges. The cams remain in the chills until the molds are knocked out, but, while the edge of the cam is exceedingly hard, the rest of the casting is not affected. These cams come true to the desired shape and size, and any style of cam can be readily made from its corresponding chill. The cams shrink slightly so that they drop out of the chills without trouble. This is one of the best and cheapest cams for gas engine purposes.

IMPROVING OPERATING CONDITIONS.

By P. W. Blair.

THE President of a brass manufacturing plant in a central western Canadian city who makes two trips a week over his entire plant noticed on one of his trips that two new and inexperienced girl coremakers were working at one of the core-benches. He stood for a few minutes watching them at work making cores, and noted that although they were doing their best they were making but little progress. Calling the foreman, he enquired as to the absence of the experienced girls who previously occupied that core bench. The foreman informed him that he could not keep them during the hot weather. "In summer time, they get lazy I guess," said the foreman.

The president, who had grasped the situation, replied "well I would get lazy too, if working in a place like this. I will send the electrician down here at once to put in electric fans wherever they are needed, after which we will put in skylights. When this is done you make it a point to get word to the girls who have quit that the core-room has been made more comfortable, also get the same word to any exceptionally good workers who have been here and see if we can't get them back. This time of the year is our rush season, and we can't afford our experienced coremakers to lay off."

The improved arrangements brought back some of the experienced girls at once, and since that time there has been much less "laying off" on hot days. The management has found the fans a good investment, and many other manufacturers can learn a lesson from the above experience by looking after the sanitary conditions and welfare of the employees.

NOVA SCOTIA STEEL & COAL CO.

MR. R. E. HARRIS, K.C., president of the Nova Scotia Steel & Coal Co., who, with Mr. Thomas Cantley, vice-president and general manager, visited recently the company's works at Sydney Mines, on being asked as to the truth of the rumor that the company contemplated the closing down of the collieries and furnaces for several months, said:

"There is a very general depression to-day in business throughout Canada. We are feeling this depression in common with other industries. We now have a considerable accumulation of pig iron, which it is not desirable to further increase. Our blast furnace department may close down for some weeks. The output of coke and steel will also probably be somewhat reduced, pending the return of normal conditions.

"We may be forced to reduce the number of employes at the collieries, but we hope by practising rigid economy to be able to keep them all working throughout the winter. Every effort will be made by the management of every department to keep the hitherto steady workmen employed. I do not think the present depression will be of long duration."

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

NIAGARA BOTTOM FLANGING MACHINE.

A NEW bottom flanging machine designed and built by the Niagara Machine & Tool Works, Buffalo, N.Y., is shown in the accompanying half-tone. The machine is intended for the manufacture of heads and bottoms for barrels, tanks, steel vessels, boilers, etc., and should prove particularly useful where it is required to produce heads of various diameters, as it would prove practically prohibitive to do the work on presses and dies, especially when the requirements were limited.

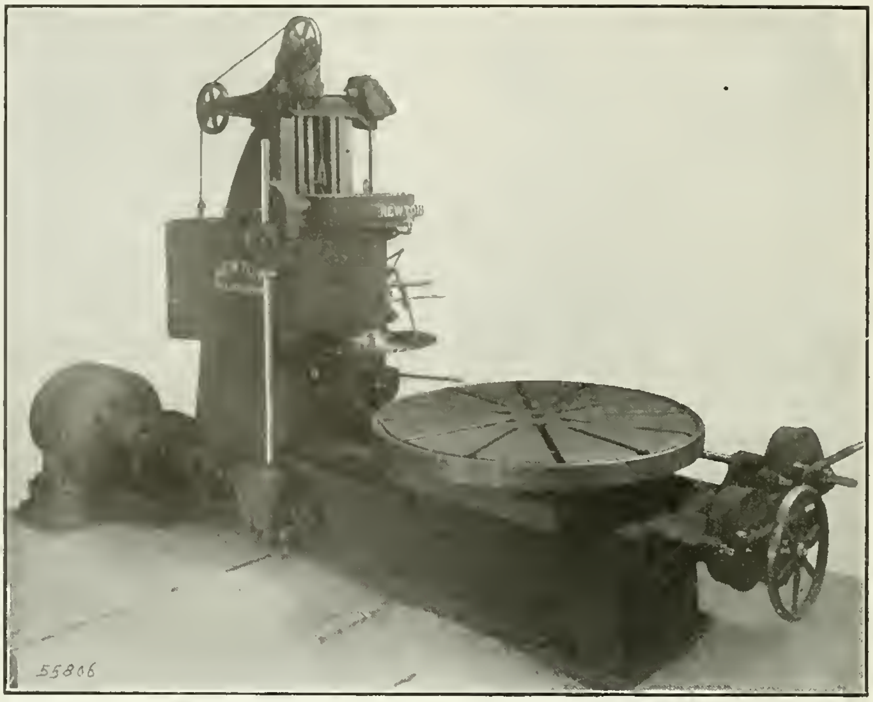
Besides forming flanges, different shapes can be produced by substituting suitable shaped forming rolls. The machine can also be used as a circle and slitting shear, in which case, the flanging rolls have to be removed and replaced by cutters.

The machine is single back-geared and is provided with fast and loose pulleys. The main gear is mounted on the lower shaft while the upper shaft is driven from the lower one by means of the compensating connecting gear. The upper shaft can be raised and lowered, while always retaining its horizontal position by means of screws, strippers, gears and hand wheel, mounted on top of machine.

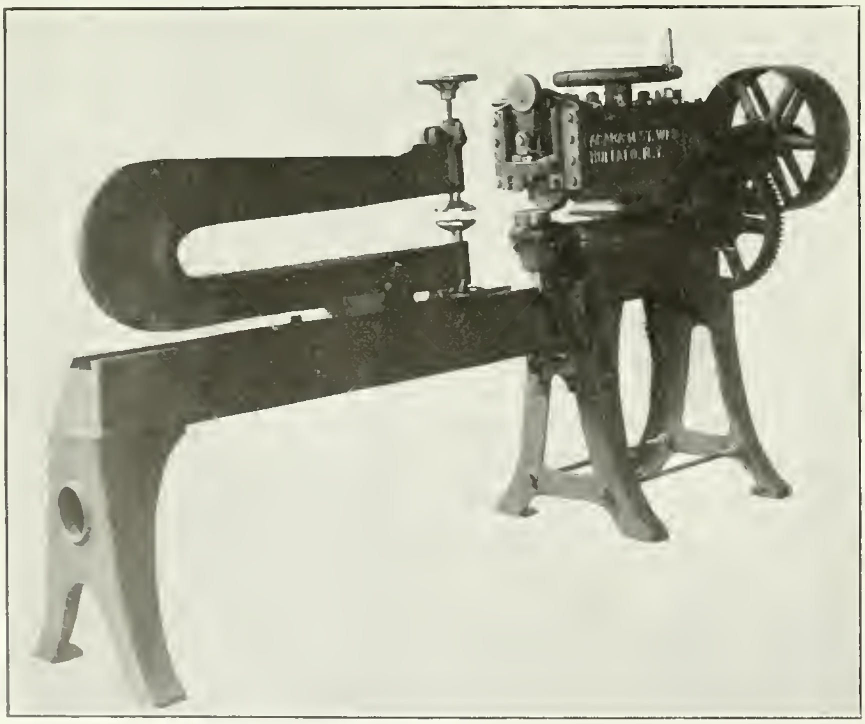
To prevent the metal from being distorted during the flanging operation, two hold down rolls, mounted on the slide in front of upper flanged rolls can be quickly raised and lowered by means of an eccentric lever.

The lower flanged roll is mounted on a vertical shaft. The latter being driven from the main shaft of bevel gears. The upper shaft can be adjusted laterally to allow for metal of different thicknesses. For this purpose, an eccentric segment lever is located at the front side of machine within easy reach of the operator.

The machine will flange discs from 14 in. to 60 in. diameter of No. 10 gauge metal, the maximum height of flange being $1\frac{1}{2}$ inches.



NEW DESIGN COLD METAL SAWING MACHINE.


BOTTOM FLANGING MACHINE.

NEW DESIGN COLD METAL SAWING MACHINE.

THE accompanying illustration shows the first of a new design of Cold Metal Sawing Machine having a vertical spindle with a blade in horizontal position for cutting off risers from flat circular castings, such as, engine driving wheels, large spur gears, propeller blades, etc. This particular machine was furnished to the United States Government by the Newton Machine Tool Works, Philadelphia, Pa., to operate largely on mountings for rapid fire guns, which have a large number of sink heads, and it is figured that there will be a saving of at least twenty out of the twenty-five

hours formerly necessary for this particular job.

The machine is equipped with a Taylor-Newbold new design inserted tooth blade 30 inches in diameter and having temperate steel body. The capacity for round stock in one cut is $8\frac{1}{2}$ in.; diameter of circular table over all 60 in.; minimum distance centre of blade to top of table 1 in.; maximum distance blade to table 24 in.; distance centre of spindle to frame 15 in.; in and out adjustment to table sufficient to swing 72 in. diameters in front of a 30 in. blade.

The machine is driven by a General Electric, RLC, 116, 10 h.p. semi-enclosed motor, running at 600 to 1.200 r.p.m., complete with drum controller. The spindle is driven by a large diameter worm wheel having a bronze ring with teeth of steep lead, and a hardened steel worm fitted with roller thrust bearings, so arranged that thrust of both is taken by a common casting, and both the worm and worm wheel revolve continually in a bath of oil.

The spindle saddle is counterweighted, has reversing, vertical fast power traverse in addition to hand adjustment with provision for locking securely at any desired height. Side adjustment of the saddle on the frame is made by means of taper shoes. Motion for the drive and all movements from the motor are transmitted through spur and bevel gears to the vertical driving spline shaft, and also through the double train of bevel gears engaged by the Carlyle-Johnson friction clutch, controlling the feed and fast power motion. This transmission is clearly shown in the illustration.

On the opposite side of the machine, the motion is transmitted through a box having eight gears, giving six changes of circular and longitudinal feed, both of which are independently clutched as shown in front of photograph. The work table has end slots, and the lubricant is carried through the centre of the table, saddle and base to a reservoir in the base for re-distribution by means of a gear pump. In addition to the gear feeds to the circular table, reversing fast power traverse and reversing longitudinal fast power traverse in addition to hand control are available. The machine occupies a floor space of 12 ft. x 5 ft., and weighs 20,000 pounds complete.

During the preliminary test on the builders' erecting floor without foundations, the following data was secured:

With the machine running light, blade rotating a 65 periphery feed per minute, the motor took 6 amperes, and the following operations to test the feed on 5 in. diameter, 35 carbon stock, were made.

Circular feeds No. 3, 6 min. 15 sec. per cut, 24 amperes, 228 volts.

Circular feeds No. 5, 3 min. 20 sec. per cut, 28 amperes, 228 volts.

Circular feeds No. 4, 5 min. 30 sec.

Circular feeds No. 6, 2 min. 10 sec. per cut, 36 amperes, 228 volts.

Straight feeds No. 4, 5 min. 30 sec. per cut, 24 amperes, 228 volts.

Straight feeds No. 6, 2 min. 45 sec. per cut, 34 amperes, 228 volts.

In addition to these, a number of other cuts were taken with the blade in good condition. It should further be understood, that any of these feeds could be used on the circular, as well as the longitudinal directions. It was found that the blade on this machine rotated more smoothly than even the horizontal types, which are the maker's standards, and as the present average feeds in steel foundries range from $\frac{5}{8}$ in. to $\frac{3}{4}$ in. per minute, it will be realized that this machine which easily cuts $2\frac{1}{2}$ in. per minute is destined to make new records in steel foundry practice.

Montreal, Que. On January 13, fire did damage to the plant of the Canadian Tube & Iron Co., Ltd. The blaze originated in the roof of the boiler house which was seriously damaged as were also the electrical department, and the nut and bolt shop. The loss is estimated at about $15,000 and is covered by insurance.

A NEW DIXON CRUCIBLE.

THE illustration shows a new crucible which has been evolved by Henry Weisbrodt, an employe of the Joseph Dixon Crucible Co., to be used by melters of precious metals. It has been designed to do away with skimming, and also to prevent the possible chance of charcoal or molten fluxes getting into the ingot or casting. This crucible has a bridge at the top, which, on pouring the metal, holds back the charcoal and foreign matter, and so delivers clean metal. The new design does not in any way reduce the holding capacity of the crucible, and the metal can be stirred as satisfactorily as in a regular crucible.

A NEW DIXON CRUCIBLE.

The Dominion Iron & Steel Co., Sydney, N.S., has received a five thousand ton rail order from the Australian Government. This is the first of a series of orders which the Southern colony will give the Sydney plant. The rail mill is finishing a large order for the Canadian Northern, following which the mill will be off ten days for repairs. After the Australian order is finished, a big order for the C.P.R. will be rolled, and later a 12,000 ton order of sixtys for a western firm. The bar mill is manufacturing some 15,000 tons of reinforced concrete rods for the Welland canal. The plant is running full blast with normal pay roll.

INDUSTRIAL NOTABILITIES--No. 18

ILL-HEALTH or accident often changes the course of a man's life, and makes him a millionaire, whereas his forsaken profession would have narrowed him down in a small town. Particularly is this true in politics. Some of Canada's premiers have been plucked from editorial desks in obscure towns, or have put aside their lawyer's gowns. The subject of our sketch was never a prime minister, but for years has been a premier among Canadian manufacturers. Cyrus Albert Birge is mainly interested in such things as tacks, screws, and agricultural implements. When a young man, his thoughts were centred on sore stomachs, pneumonia, appendicitis, and things like that. His ambition was to become a doctor, but he needed a physician himself. Regretfully he abandoned his studies after matriculating at Victoria College of Medicine, Toronto.

There is as big a contrast between tin tacks and pills and peaches, but Cyrus H. Birge, in his younger days, seems to have been a man who could turn his hand to anything that would produce money. Thus, after abandoning medicine, he went into the grocery business for himself at Stratford. After two years he sold out, and started another store at Chatham, Ont.

His next move was as an accountant with the Great Western Railway of Canada (now part of the Grand Trunk), where he remained for ten years in the engineering department.

CYRUS ALBERT BIRGE.

In 1882 he resigned, and took the position of manager of the Canada Screw Co. In 1883 he was made its general manager and vice-president, and in 1898 bought the entire business from the American Screw Co., of Providence, R.I. He re-organized the Canada Screw Co., and became its president. In 1906 Mr. Birge amalgamated the Ontario Tack Co. with the Canada Screw Co., under the latter name, and in 1910 this was merged with the Steel Company of Canada, composed of the Canada Screw Co., Hamilton Steel & Iron Co., Montreal Rolling Mills, Dominion Wire & Manufacturing Co., of Montreal, and the Canada Bolt & Nut Co. Mr. Birge is vice-president of the Steel Company of Canada, vice-president of th Hamilton Stove & Heater Co., director in the Sawyer-Massey Co., of Hamilton, director in the Bank of Hamilton, vice-president of the Mercantile Trust Co., of Hamilton, president of the Sovereign Fire Insurance Co., director British American Oil Company and many others.

Mr. Birge was born at Oakville, Ont., November 7, 1847. In his married life he has been most unfortunate. He has lost two wives by death. In 1908 he married his third wife. There are several children living. His residence is in Hamilton, Ont.

Mr. Birge is a member of the Hamilton Club, National Club, Toronto, Caledon Mountain Trout Club, Hamilton Golf Club, the A.O.U.W., and is an Oddfellow. He has been vice-president of the Hamilton Board of Trade, and also of the Canadian Manufacturers' Association.

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Vol. XI. JANUARY 22, 1914 No. 4

PRINCIPAL CONTENTS.

TEACHING AUTOGENOUS WELDING.

AUTOGENOUS welding, which only a few years ago was looked upon as a novelty of somewhat doubtful value, has now become an almost indispensable adjunct to many industries. The oxy-acetylene and oxy-hydrogen torch, both for welding and cutting, is now recognized as a very great labor-saving device, and is becoming widely used in the metal-working trades, not only for repair work, but also for manufacturing purposes.

In autogenous welding, it is universally admitted that the reliability of the results attained are very largely dependent on the skill of the operator, and this will probably always be the case. In small plants, where the process is only occasionally employed to effect repairs to some badly needed forging or casting, it has been usual to call in an expert employed by some firm making a specialty of this class of work, and even in our large railway shops, where the process may be in practically continuous use, it is not uncommon to find only one or two men, among the many hundreds employed, who know anything about it.

This has perhaps been unavoidable hitherto, as most of the operators have picked up their welding knowledge in the shop where they were employed, and while these have for the most part become experts, when they leave the shop or are promoted to some higher position, it is hard to replace them, an inexperienced man having usually to be broken in "ab initio" to fill the vacancy. It is, therefore, interesting to note that the Montreal Technical School, recognizing the local demand for skilled welders, are conducting a weekly evening class in autogenous welding at which practical and theoretical instruction in the art is being given by experts. Each lesson lasts two hours, and there are ten lessons in the course.

While it is not suggested that a student can become an expert welder after only twenty hours' instruction, much can be done in that time to impart a good grounding in the subject, and to stimulate a desire for further knowledge of the work. Several men who are employed at this work during the day are attending the class, which is an extremely encouraging sign, for it were safe to say that the majority of operators are not familiar with the theoretical side of the subject, though they may be able to obtain very fair results in practice.

The present is the second winter that this course has been conducted. Last year it met with great success, and many old students are now taking a second-year course. This move on the part of the management of the Montreal Technical School is to be heartily commended, and we wish the class continued success. It is hoped in the near future to give instruction in this subject to day students also, the difficulty hitherto having been to secure the services of practical demonstrators during the day time.

Autogenous welding, in addition to filling an important niche in mechanical engineering work generally, becomes, in the case of factory operation, of inestimable value in preventing shut-downs of long duration. Expensive repairs to broken or fractured parts of the equipment, and even the necessity of replacement by entirely new pieces, have been and are being offset by the successful application of the process. It is incumbent, therefore, that master mechanics in factories, and particularly those directly responsible for advice concerning the carrying out of repairs, should be conversant with what is being accomplished in the direction of saving valuable equipment, which disaster may have overtaken, and of being able to discern when it is possible to have the work done, to all intents and purposes without removal from the plant. The progress of autogenous welding has been marked by rapidity and success due to merit, and it is our belief that near future development will increase its value even more so than in the past.

SELECTED MARKET QUOTATIONS

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	Montreal.	Toronto.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3....	20 00	21 50
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3.......	20 00	22 00
Clarence, No. 3........	20 50	21 00
Jarrow	.....	23 50
Glengarnock	......	26 00
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1........	19 40	18 35
Victoria, No. 2X	19 15	18 10
Victoria No. 2 Plain ..	18 90	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh.........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2,05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal......	2.10
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh.....	1.20
Steel hoops, Pittsburgh..........	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ in., 100 lbs...	$2 30	$2 20
Heads, per 100 lbs.......	2 55	2 55
Tank plates, 3-16 in......	2 60	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	9 00	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate Washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb off
Nuts, Hexagon, all sizes..	4½ per lb off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright	....85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	........75, 10, 7½, 10 p.c. off
Wood screws, flathead, bronze	....70, 10, 7½, 10 p.c. off

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in...	75%
Finished Nuts over 1 in....	72%
Semi-Fin. Nuts up to 1 in..	72%
Semi-Fin. Nuts over 1 in...	72%
Studs....................	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 00	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings..	9 00	9 00
No. 1 wrought iron.....	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	13 00	12 00
New brass clippings....	8 50	8 75
No. 1 brass turnings....	7 25	7 50
Heavy lead	3 75	4 00
Tea lead	3 00	3 00
Scrap zinc	3 00	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$. 32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	.....	...	.....
10 in	3.50	....	.....	....	.....
10 in	4.12	....	.....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in. ..	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 75	$16 00
Electrolytic copper	15 60	15 75
Casting copper	15 15	15 50
Spelter	5 25	5 25
Tin	38 50	40 00
Lead	5 15	5 40
Antimony	8 50	8 50
Aluminum	21 00	19 00

SHEETS.

	Montreal.	Toronto.
Sheets, black, No. 28	$2.75	$2.70
Canada plates, ordinary, 52 sheets	2.75	2.75
Canada plates, all bright	4.00	4.15
Apollo brand, 10¾ oz. (American)	4.30	4.20
Queen's Head, 28 B.W.G.	4.40	4.40
Fleur-de-Lis, 28 B.W.G.	4.20	4.25
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.40	4.40

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.26
Benzine, per gal.	23½
Pure turpentine	0.60
Linseed oil, raw	0.60
Linseed oil, boiled	0.63
Plaster of Paris, per bbl.	2.10
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Jan. 19, 1914.—This month is always one that is largely taken up with making inventories, stocktaking, etc., so that trade is seldom very brisk during the first few weeks of the year; but while most lines are still quiet, and it is difficult to point to any branch of trade showing a marked improvement this week, the general tendency is slightly better. Collections, however, are still far from good.

Machinery brokers are not worrying much; in fact, they are quite optimistic. A leading house said this morning that prospects were a good deal brighter than they were a month ago. The railways are once more beginning to show some interest in the prices of machinery, and some fair enquiries have been received, though no specifications have as yet been issued.

The plant of the Canadian Tube and Iron Co., Ltd., was damaged by fire last week. The roof of the boiler house was destroyed, and damage was also done to the nut and bolt department, which was put out of commission. This section, however, will be in operation again in the course of four or five days, according to a statement issued by the firm. The wrought iron pipe department was not affected.

The warehouse of Frothingham & Workman also suffered from fire on the same day, the building being completely gutted. The loss is estimated at $200,000, all of which is covered by insurance.

Metals.

The metal market remains dull. A little business is being done in pig iron, but consumption continues to be of the "hand-to-mouth" order, and enquiries for spring supplies are not yet being made.

With regard to the steel market, recent press reports from Pittsburgh stating that large orders had been received appear to have been greatly exaggerated. Probably no great improvement need be looked for before the first or second week in February.

Toronto, Ont., Jan. 20, 1914.—The price of wire in the United States has advanced a dollar per ton, but Canadian manufacturers have left their price unchanged, and are taking advantage of the increase across the line. Since the latter occurred, the wire business in Canada has been exceptionally good.

Business in steel bars has not improved greatly at the Canadian mills. All consumers are specifying more, and, as they have allowed their stocks to get low, and realize that the price of bars is as low as it will go, quite a number are buying, or are about to buy. There has also been some good business done in pig iron during the past few days; in fact, the most marked jump in business this week is in pig iron. Manufacturers, however, are not disposed to say much.

Business in nails is only fair. The price dropped last week for steel wire nails, base, from $2.30 to $2.15. The prices of cut nails and spikes remain the same. This is not the first reduction in the price of nails in Canada since last summer. Another reduction is in iron rivets, the discount on which is now 60, 10 and 10, an increase of 10 per cent. It will be noticed that the discount on iron pipe fittings have undergone an appreciable change.

Machine Tools.

There has been a marked improvement in the machine tool market since the first of the year, though the improvement is more in inquiries than in actual business. One of the chief inquiries comes from the Hamilton Bridge Co., who are increasing their equipment by the addition of lathes, radial drills, planers, milling machines. The inquiries are usually from new concerns, and are for new machines. There is a marked tendency, however, owing to the tightness of money, for purchasers to offer old machine tools in part payment for new ones. This is being done quite a lot in the United States to secure business.

British Machine Tools.

There has been considerable discussion lately regarding the difficulty of the British manufacturer securing a hold in Canada in competition with Canadian and American concerns. A case this week showed why there is this difficulty. A local concern have an English planer, which they like. They wanted another like it, quickly. A cable was sent. The reply stated that delivery would take place in six weeks, which means that it will be ten to twelve weeks before it gets here. Then, when it arrives, it is knocked down, and requires to be assembled.

Canadian customers will not wait all this while for delivery. British machine tool makers have been enjoying remarkable prosperity lately, but it is not long since the above planer was kept in stock, and could be shipped immediately. There are lots of machines to be picked up in England, but they are not what are marketable in Canada. Dealers often find it safer and cheaper to quote on Canadian and American machines unless the customer has a distinct preference for British tools. A local firm placed an order for tools with a British firm, and, after a year and a half, the goods not having been delivered, the order was cancelled.

The Hendee Mfg. Co., Toronto, branch of the Springfield, Mass., makers of the Indian motor-cycle, who have an assembling plant here, have added a milling machine to their equipment. The manager announces that if business increases at the present rate, it will be necessary to erect a branch plant here.

Metals.

It will be noticed that the price of aluminum is lower this week. We are informed that the market for this metal is dull, and that there is little demand for it just now. The metal business generally is quiet. Little scrap is being sold. Copper is cheaper. People are just buying to fill immediate requirements.

INDUSTRIAL NOVA SCOTIA

AN effort has been successfully carried out to demonstrate to the world the progress that Nova Scotia has made in the field of manufacturing. We refer to a book entitled, "The Industrial Ascendancy of Nova Scotia," which has recently been published by the Nova Scotia Branch of the Canadian Manufacturers' Association. This volume is a picture story of the principal manufactories in Nova Scotia, and will, we are sure, prove an eye-opener to many with respect to the industrial development that has taken place in Nova Scotia, and particularly in such centres as Amherst, New Glasgow and Sydney. An impression exists in some quarters that Nova Scotia is not a manufacturing Province, but such an impression will certainly be dissipated by a perusal of this finely-illustrated publication.

The contest for business to-day is as strenuous between countries as it is between individuals, and the same qualities that count for the success of the individual in the competitive field count equally for the success of a Province or Nation. The more a man becomes known for efficiency in what he is attempting to do, the more business is likely to come his way. Consequently, as Nova Scotia becomes recognized more widely as a place where manufacturing can be carried on successfully, the confidence of outsiders will be correspondingly enlarged. Wherever this booklet goes it will be an ocular demonstration of the progress that Nova Scotia has made in the creation of factories. Indeed, the volume is designed not only to change the opinion of those who think of Nova Scotia as merely a producer of fish, farm products, and lumber, but also to induce an interest among capitalists in the establishment of additional factories in that Province. Copies of the booklet may be obtained by writing the secretary of the Publicity Committee, Nova Scotia Branch, Halifax.

Personal

H. M. Morrow of the motor truck department of the Canadian Fairbanks-Morse Co., Toronto, has been transferred to the Vancouver branch.

H. B. Taylor, M. Am. Society M.E., gave a paper on the design and construction of hydraulic turbines at the meeting of the Montreal branch of the Canadian Society of Civil Engineers on Thursday last, Jan. 15.

A. M. Moseley, manager of the Page-Hersey Pipe Mills, Welland, who is leaving to take charge of the company's new plant at Fort William, was presented by members of the Welland Club on Monday last with a decanter, silver tray, and a dozen cut glass tumblers. L. B. Spencer, president of the club, made the presentation.

New Incorporations

Woodworkers, Ltd., incorporated at Toronto, capital $40,000, to manufacture wooden articles at Toronto. Incorporators: Louis F. Strickland, Alexander B. Beverly, etc., Berlin.

Taylor Portable Steel Derrick, Ltd., incorporated at Toronto, capital $40,000, to manufacture, buy, sell and deal in derricks, machinery, tools and hardware of all kinds at Toronto. Incorporators: George M. Kelley, John D. Falconbridge, etc., Toronto.

The Maritime and Newfoundland Steamship Co. Ltd., incorporated at Ottawa, capital $150,000, to carry on a general shipping business, at Halifax, N.S. Incorporators: James G. Farquhar, Charles W. Rowlings, etc., Halifax.

Muskoka Lakes Supply Co., Ltd., incorporated at Toronto, capital $40,000, to engage in the business of boat building, plumbing and furnishing boat supplies and boat repairs, at Port Sandfield, Ont. Incorporators: Richard A. Shields, New York, Edwin Rogers, etc., Port Sandfield.

The Northern Electric Co. Ltd., incorporated at Ottawa, capital $10,000,000 to manufacture and deal in every kind of metal, machinery, apparatus and device, and the appurtenances of the same, at Montreal. Incorporators: Harry F. Sare, George R. Gray, etc., Montreal, Que.

The Canadian Hotpoint Electric Heating Co. Ltd., incorporated at Ottawa, capital $100,000, to carry on business as manufacturers, exporters and importers of electric heating, lighting and power appliances and devices, at Toronto. Incorporators: Earl Holmes Richardson, Percy H. Booth, Ontario, Cal.

Montreal, Que.—The Albion Motor Car Co. of Canada, Ltd., have been incorporated at Ottawa, capital $75,000, to manufacture all kinds of motor vehicles and other vehicles and conveyances, and all parts or accessories useful or necessary in connection therewith; the tools and machinery required for the manufacture and maintenance of same. Incorporators: Alexander H. Duff, Walter A. Merrill, etc., Montreal.

Cap de la Magdeleine, Que.—The Modern Foundry and Soil Pipe Co., Ltd., have been incorporated at Ottawa, capital $250,000, to acquire the business now carried on by the "Modern Joint of Montreal, Ltd.," and to carry on the business of general foundrymen, manufacturers of all kinds of pipes, machinists, smiths, patternmakers, and electricians. Incorporators: Louis Adolphe Payette, Joseph Galipeau, etc., Montreal.

Coaticook, Que.—A. O. Norton, Ltd., have been incorporated at Ottawa, capital $250,000, to acquire all the property belonging to A. O. Norton, incorporated, situated in Coaticook, Que., together with the business and good-will attached thereto, and to pay for the same either in cash or in shares of this company; to manufacture lifting jacks and all kinds of tools and machinery, supplies for railroads, steamships, mines and mills; and to do a general machine shop business. Incorporators: Arthur O. Norton, Mary H. Norton, etc., Hatley, Que.

Catalogues

The Herbert Morris Crane & Hoist Co., Ltd., Peter Street, Toronto, have issued a bulletin, A-11, dealing with the Morris triple-gear chain blocks. The illustrations include views of the component parts of a chain block and also one in operation. Copies may be had by writing the company.

The Jeffrey Mfg. Co., Columbus, Ohio., have issued recently a new bulletin, No. 63-A, containing price lists of the "Jeffrey" detachable link chain attachments and wheels. The many types of links and attachments made by this company are fully illustrated and tables included give the principal dimensions in addition to the prices. Copies of this bulletin may be obtained from the company's office at Montreal, P.Q.

Gears and Rolling Mill Pinions is the title of Bulletin K which is being distributed by the Mesta Machine Co., Pittsburgh. Illustrations are given of large gears being machined, and also of some large pinions, while the reading matter deals with cut gears in a concise manner. The bulletin also contains some data on gears and diagrams of safe loads for mouded gears and pinions of cast steel.

The Casler Offset Boring Head is described fully in catalog "D" which we have received from Marvin & Casler Co., Canastota, N.Y. The application of the "Casler" head is dealt with fully, together with several illustrations showing it mounted on turret lathes, milling machines and drill presses. The catalog also contains a number of tables and specifications giving the principal dimensions of each size of head and also of the boring bars that fit in the head. Copies will be sent to interested readers.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

St. Thomas, Ont.—The new locomotive shops of the Michigan Central Railway are nearly completed.

St. Catharines, Ont. — Steel and Radiation, Ltd., resumed operations last week with a full staff.

Preston, Ont.—Clare Bros. & Co., manufacturers of stoves, etc., are in the market for a radial drill.

Woodstock, Ont.—The town is erecting a manual training school for which machinery is being purchased.

St. Thomas, Ont.—Important changes are contemplated by the Board of Education in connection with the manual training school.

St. John, N.B.—T. McAvity & Sons, Ltd., advise that it will be some time before they are in the market for equipment for their new plant.

Pembroke, Ont.—The ratepayers have voted favorably on a by-law to give a site costing $5,000 to the Harwood Specialties Co., who will erect a plant here.

Hamilton, Ont.—The Hamilton Bridge Co. is in the market for a large number of machine tools, consisting of lathes, radial drills, planers, milling machines, etc.

Rock Island, Que.—The plant of the Union Twist Drill Co. will be erected here, which is just across from Derby Line, Vt. It will be used by Butterfield & Co.

Dundas, Ont. — The Canada Crushed Stone Corporation who suffered a loss of about $20,000 on Friday, Jan. 9, by a fire which destroyed their plant, will rebuild.

Trenton, N.S.—The Eastern Car Co., who use the product of the Nova Scotia Steel and Coal Co., are running at full capacity, and extensions will be made to the plant this year.

Medicine Hat, Alta. — The International Supply Co. will manufacture a new line this year. They will make a gas engine, principally for the Western trade. W. R. Martin is manager.

Vancouver, B.C.—M. A. Ryan, Superior, Wis., has written to the Progress Club expressing a desire to establish a boiler works in this city. He is manager of a similar plant in Superior.

Southampton, Ont.—The ratepayers have passed a by-law granting the Steel Furniture and Fittings, Ltd., a free site for a new plant and exemption from taxation for ten years.

Galt, Ont.—The Galt Stove and Furnace Co. have offered part of their new addition to a new Ohio concern until they can erect a plant on a site in Jackson Park. The building will be a single-storey structure, 300 x 60 feet.

Brantford, Ont.—Goold-Shapley and Muir Co., who have just closed a splendid year, will manufacture a new oil engine, to use coal oil instead of gasoline. They are also putting out an improved windmill.

Woodstock, N. B.—Operations at the foundry of Connell Bros., Ltd., have been suspended for financial reasons. As the assets far exceed the liabilities, it is expected that this old-established concern will soon be running full again.

Grimsby, Ont.—The Canadian Steel Specialty Co. are installing machinery in their new plant, but are unable to complete the work owing to the large number of orders on hand. They recently received an order for a thousand opera chairs.

Redcliffe, Alta. — The Rolling Mills and Bolt Works commenced operations again on Monday, Jan. 5, after being closed throughout the holiday season. The company is now employing about 75 men, and expect to keep the plant running steadily throughout the year.

Welland, Ont.—The Michigan Central Railway will extend their line from Welland to Dain City. It is believed that this is to accommodate the Dain Company, and that the John Deere Plow Co. will proceed with the erection of their $2,000,000 plant in the Spring.

Sarnia, Ont.—The Reid Wrecking Co. of Sarnia will spend nearly $70,000 on their drydocks at Port Huron. A new steel structure equipped with the latest machinery and apparatus for ship repairing will be erected at a cost of about $45,000, and about $25,000 will be spent on a modern new pump house.

Vancouver, B.C.—The Vancouver Iron and Metal Co. will prepare plans for a new foundry, costing about $25,000.

Montreal, Que.—The Canadian Tube and Iron Co. plant was damaged by fire recently. The bolt and nut department was out of commission for a few days. The wrought pipe department was not injured.

Sydney, N.S.—The rail and blooming mills of the Dominion Iron and Steel Co., which have been running continuously for several years, closed down last week for repairs. This is to allow of the ingot heating furnace being installed and the machinery being overhauled.

Edmonton, Alta.—So that it might construct buildings in this city for the manufacture of its products, the Winnipeg Ceiling and Roofing Co. and Edmonton Metals, Ltd., through the president, M. J. McMartin, have purchased trackage property, comprising block 17, Cromdale, south and east of the G.T.P. tracks.

Hamilton, Ont.—Wm. H. Marsh, manager of the Standard Underground Cable Co. of Canada, announces that the capital of the company has been increased from $500,000 to $1,000,000, and that several important extensions will be made to the plant during this year, and that the staff would be considerably augmented.

Ottawa, Ont.—J. E. Ray, acting trade commissioner in Great Britain, reports that British manufacturers of motorcars will erect depots, consisting of garage, repair shop and assembling factories at several points from coast to coast, to develop later into branch factories. Subsidiary companies will be floated here, with Dominion charters.

Woodstock, Ont.—Since the ratepayers voted a bonus of $20,000 to the Concrete Machinery Co.—an amalgamation of the Mitchell Concrete Machinery Co.; Toronto, and the Wind Motor Co., Woodstock—work on the new plant has been rushed, so that in a short time it will be ready for the machinery. Mr. Thomas Watson, manager of the Wind Motor Co. has been purchasing a few tools, but a total of $15,000 will be spent on equipment and additions to building. Among the equipment required will be an oxy-acetylene welding ap-

paratus Road machinery, crushers, and tile and concrete machinery will be made. R. L. Mitchell, 75 Indian Grove Ave., Toronto, is interested.

Chatham, Ont.—The National Forging Co., organized in October to manufacture automobile and carriage forgings, are now in the market for a considerable quantity of machine tools. They will occupy the old plant of the Swift Motor Car Co., and are understood to be connected in some way with the Ford Motor Co. The company is capitalized at $100,000. Mr. Hess, Chatham, is interested, as well as several wealthy Americans.

Granby Bay, B.C.—Within five weeks the new $2,500,000 smelting plants of the Granby Smelting Co. will begin operations. The plant has been put in primarily to handle the output of the Hidden Creek copper mines, but ores from properties owned by other companies and individuals will be handled. The plant is intended to treat about 5,000 tons of ore a day, and is modern in every respect, including a hydro-electric power plant and machine shops.

Electrical

Kingston, Ont.—$27,000 will be spent for extensions to conduits.

Lynden, Ont.—Hydro-Electric engineers are preparing estimates for a line to Lynden.

Swift Current, Sask., is advertising for an electrical superintendent for its power house. Geo. D. Arnott, sec-treas.

Weston, Ont.—The Electric Light and Waterworks Commission will use the old power house as an auxiliary to the Hydro-Electric supply.

St. Catharines, Ont.—The Hydro-Electric Commission is looking for a permanent office and showroom.

Collingwood, Ont.—By-laws providing $55,000 for waterworks and electric light, $20,000 for the purpose of erecting a new town hall, both carried.

Goderich, Ont. — Several Goderich firms are buying electrical machinery in anticipation of Hydro-electric power being available.

Amherst, N.S.—The Canada Electric Co., of Amherst, N.S., have prepared plans for a 1,000 k.w. turbo-generator set for installation at Chignecto.

Ottawa, Ont.—It is understood that the Government has engineers preparing plans for the lighting of the Rideau Canal from Ottawa to Kingston by incandescent lamps.

Port Stanley, Ont.—The Government will install a lighting system for the piers and warehouse here. Mr. Craig of the Public Works Department, Windsor, is securing necessary data.

Kincardine, Ont.—The Hydro-Electric commission engineers are investigating the water powers of Bruce, believing that the ultimate solution of the power difficulty will be some local development.

Brantford, Ont.—Brantford township has not yet given up attempts to secure Hydro-electric power. Efforts are being made to have street and domestic lighting in Parkdale, Echo Place and Grand View.

Havelock, Ont.—A Hydro-Electric consulting engineer has advised the town to purchase the electric light plant in the town rather than obtain power from an outside company and transmit it over a long distance.

Regina, Sask.—A motor generator and three turbo-generators are being installed; the former in the old power house, and the latter in a new building. The two 400 k.w. units in the old power house will be used as a standby.

Chilliwack, B.C.—The town will make a new contract for the lighting of the city with the British Columbia Electric Co. An entirely new system will be installed by the B. C. E. R., 100 c.p. Tungsten lights replacing the old 32 c.p. incandescent lights.

Gananoque, Ont. — The 1,000 horse power of electric energy from the plant at Kingston Mills, arranged for in the town's contract with J. M. Campbell, of Kingston, will be available for the use of local manufacturers early in the spring.

Halifax, N.S.—The Halifax Power Co., is understood to be planning to place hydro-electric current in Halifax next summer, generated at Indian River, fifteen miles from Halifax. The Company can only supply current for power purposes.

St. John's, Nfld.—Additional development of resources is expected from negotiations now under way by the Government for utilizing the large water powers of Labrador, and for establishing railway service between the east and the west coasts of the island with a ferry to the Canadian border.

Englehart, Ont.—The Charlton-Englehart Power Co. expect to have their plant in Charlton completed in about two months. Sutcliffe & Neelands of Liskeard, are building it. The steel flume, 7 ft. diam., is in place, and the wheel houses are nearing completion. The William Hamilton Co. of Peterboro, have the contract for the machinery.

London, Ont.—An addition to the hydro station in London, equal in area to the present building, is contemplated at the present time. The size will depend on the decision of Chief Engineer Gaby, of the Hydro-Electric Commission, as to whether the power for the London and Port Stanley Railway will be taken from the main station or from another building to be erected along the line, either in Chelsea Green or closer to the city limits.

Wood-Working

Fort William, Ont.—Construction work on J. P. Bertrand's new lumber mill started last week.

Granby, Que.—The drying kiln of the Myers Thomas Box Co. factory was destroyed by fire last week.

Green City, B.C. — George H. Green, Green City, near Salmo, B.C., contemplates the erection of a shingle mill in the spring.

Valley City, Alta.—The sawmill of the Valley City Lumber Co., recently destroyed by fire, will be rebuilt and considerable new machinery will be added.

New Westminster, B.C.— The Westminster Mill Co., is making plans for the erection of a refuse burner, dry kiln, drying and storage sheds, to cost about $12,000.

Fort Qu'Appelle, Sask. — The Fort Qu'Appelle Building and Woodworking Co., contemplate the erection of a planing mill in the near future at a cost of about $42,000.

Papineauville, Que.—The Papineauville Lumber Co. contemplate the erection of a mill for the manufacture of hardwood veneers for cooperage and cheese boxes.

Strathroy, Ont.—The town council have offered special inducements to the Canadian Handle Co., to rebuild its Strathroy factory, destroyed recently by fire.

Dryden, Ont.—The Dryden Timber and Power Co. will install a new evaporator. The general manager was in Chicago last week in connection with it.

Berlin, Ont.—The plans and specifications for a large and modern addition to the plant of the Interior Hardwood Co., on Wilmot street have been completed, and the work of construction will commence within the next few days.

Pembroke, Ont.—The sawmill department of the Shook Mills has resumed operations with about 40 additional men employed. This part of the factory was closed down for a month owing to inability to secure bolts because of the late arrival of the snow.

Lewiston, N.S.—The factory for making pegs and shanks was destroyed by fire on Jan. 13, throwing 100 men out of work. The machinery was destroyed, and the loss will amount to $50,000. The plant was three storeys high, and measured 620 x 40 feet.

Toronto, Ont.—The following plants were burned on Jan. 13, the damage totalling $80,000:—W. K. Rankin, excelsior packing; Parker Bros., wood turners; J. W. Woolnough, show-cases; Toronto Woodworking Co., novelty works; R. Lembke, cabinet works.

Antigonish, N.S.—The Colonial Lumber Co., a United States concern, have equipped a plant for the manufacture of hardwood flooring, veneering,, wainscotting, etc. They will commence operations in the early spring. The plant represents an investment of over $200,000. The factory is equipped with the finest of modern machinery, together with the latest constructions of kilns for drying the wood.

Building Notes

Toronto, Ont.—Horatio C. Boultbee will build a three-storey building at 63 and 65 Queen St.

Regina, Sask.—Campbell, Wilson & Strathdee will erect a five-storey warehouse at the corner of Dewdney and Cornwall Sts.

Toronto, Ont.—Holbrooks, Ltd., will erect a three-story brick and stone warehouse and office building on Foreign street, at a cost of $30,000.

Toronto, Ont.—A. Muirhead & Co. are preparing plans for the erection of a four-storey building on the corner of Frederick and King streets.

Montreal, Que.—Darling & Pearson, architects, Toronto have prepared plans for a seven-storey building for the Sun Life Assurance Co. The contractors are Messrs. Peter Lyall and Sons.

General Industrial

Lake Saskatoon, Alta.—F. N. Lawrence, of the Grande Prairie Milling Co., is purchasing new machinery to increase the capacity to 35 barrels per day.

Montreal, Que.—The Ceramo Art Glass Co. suffered a loss of $5,000 by a fire on January 12.

Caledonia, Ont. — The Haldimand Gypsum Co. contemplate the erection of a mill at the cost of $20,000.

Sauble Falls, Ont.—Messrs. M. D. Seaman & Son intend going into the manufacture of sand-lime brick.

Montreal, Que.—The mill and elevator of the Robinson-Oliver Grain Co., were destroyed by fire last week at a loss of $65,000.

Humboldt, Sask.—T. Ford and C. A. Chichester will open a steam laundry here, using electrically driven machinery.

Niagara Falls, Ont.—The Niagara Linen Co., Niagara Falls. N.Y., has purchased a site on Fourth Street, and propose erecting a $50,000 factory.

Quebec, Que.—The Provincial Government has appropriated $300,000 to build the road from Quebec to the Maine boundary, a distance of 93 miles.

Welland, Ont.—The Union Carbide Co. plant, the largest in Welland, will be finished and ready for machinery inside of a month. The Lackawanna Bridge Co. are doing the steel work.

Montreal, Que.—The five-storey warehouse of Frothingham & Workman on St. Paul St., was destroyed by fire on Jan. 13. Damage to stock amounted to $285,000; and damage to the building $20,000.

Sarnia, Ont.—Fourteen new smokestacks instead of nine will be constructed at the Imperial Oil Co. plant this year. One of the stacks will be 160 feet, and another 155 feet. The others will be smaller.

Grimsby, Ont.—The Pelee Island Wine Co. are preparing plans for a factory, 150 x 50, to be equipped with electrical machinery. There will be a cooper shop in connection with it. J. Dawe, St. Catharines, Ont., architect.

Berlin, Ont.—The Berlin Plate Glass and Mirror Co. has purchased a lot on Victoria and Edward Streets, on which a new factory building will be erected. The structure will be of two storeys, with cement foundation, and provide 13,000 feet floor space.

Elk Lake, Ont.—The Mapes-Johnson Mining Co. are moving their machinery from the Montreal-James, the plant which they purchased, to their property at Silver. The plant now being installed will furnish compressed air for the drills, and expedite the work very much.

Lethbridge, Ont.—The Bathurst Mining Co., 302 Sherlock Building, has been reorganized and have started their mine at Diamond City. They have acquired additional coal land, and will enlarge their present plant during the ensuing year. A. W. Cooley is president and manager.

Toronto, Ont.—J. L. Englehart, president of the T. & N. O. Railway, stated last week that a paper mill would shortly be built on the Abitibi River. Who the people behind the move are he was not at liberty to state, but bonds to the amount of $3,000,000 had been sold to American capitalists.

Caledonia, Ont.—A fire destroyed the plant of the Laurentia Milk Co. on January 13, causing a loss of about $25,000, only partially covered by insurance. They had recently installed some very fine machinery. The company is backed by local and Toronto capital. A. F. McLaren, ex-M.P., is president. The plant will be rebuilt.

Municipal

Herbert, Sask.—The town will spend $7,000 on a fire engine and apparatus.

Lauzon, Que.—The town is considering the erection of a new waterworks.

Brantford, Ont.—It is almost certain that the city will purchase a motor fire truck this year.

Sarnia, Ont.—Mayor Dagan favors the establishment of a municipal plant for making cement roads.

Toronto, Ont.—It is proposed to install a new electric elevator in the city hall, costing $4,500, and a sprinkler system.

Listowel, Ont. — Fire destroyed the town hall and the fire fighting apparatus, Jan. 14, doing damage amounting to $10,000.

Toronto, Ont.—The city will purchase four new auto trucks to assist in the collection of the garbage at a total cost of $24,000.

Courtright, Ont.—The council has given a final reading of the by-law to give the Union Gas Co. a 25-year franchise.

Galt, Ont.—The Waterworks Department will soon be in the market for electrically-operated valves for the pumping station.

Galt, Ont.—Frank B. Tomb, representing the Dominion Natural Gas. Co., has assured the council that a purifying plant will be built on the east side of the town where the main enters.

Fort William, Ont.—By-laws providing $37,000 for waterworks, $125,000 for telephones, $258,000 for street railway, $115,500 for electric light system, $30,000 for stone quarry, all passed.

Verdun, Que.—The city in a few weeks will be operating a new pumping plant of 4,000,000 gallons' capacity. There are also two reserve pumps of 3,000,000 gallons' capacity.

Montreal, Que.—Reports on the water situation recommend the installation of new hydraulic pumps, and a number of new mains. A high pressure system of water supply is again urged.

Peterboro, Ont.—By-laws providing $78,000 for the construction of a bridge, $8,000 for the purpose of purchasing a motor-driven combination chemical engine and hose wagon, were both defeated.

Winnipeg, Man.—The council has voted in favor of a by-law to permit a company to seek legislation for power to run a service of motor busses in Winnipeg. It is proposed to have 200 on the streets within two years.

New Liskeard, Ont.—A meeting was held here last week, when five townships were represented by the heads of the councils, to discuss the advisability of co-operating with the view to building permanent roads by purchasing a stone-crushing outfit.

Montreal, Que.—A sum of $100,000 was voted by the council for the connection of the conduit to the Lachine Canal. Instructions were also given to the Legislation Committee to ask the Legislature for power to borrow the sum of $1,000,000 in case the city wishes to build a second intake pipe.

Port Arthur, Ont.—By-laws providing $35,000 for street railway expenses, $8,000 for street lighting improvement, $55,000 for improvements to the electrical power system, $35,000 for telephone system, $53,740 for extensions to the sewer system, $202,167 for the extension of the waterworks system, all passed.

Toronto, Ont.—Works Commissioner Harris has submitted a plan to the council for the extension of the waterworks at an estimated cost of $6,677,000. The following is a list of equipment required and the estimated cost:—Pumping equipment, $380,000; boilers and stokers, $80,000; coal and ash handling machinery, $30,000; tracks and overhead equipment from York to Pumping Station, $35,000; motor and equipment for handling cars, $5,000; electric lighting unit at station, $2,000; twenty-six miles of distribution mains, $2,040,000; specials and valves, $60,000; filtration plant, $600,000; six miles of distribution main (High Level Pumping Station to West Toronto), $353,000; additions to High Level Pumping Station, and provision of steam reserve sufficient for ultimate output of this station, $250,000.

Tenders

Winnipeg, Man.—Tenders will be called for the construction of footings for the second transmission line to the power plant east of Lac du Bonnet and through the Muskeg country next week.

Toronto, Ont.—The Board of Control has extended the time for receiving tenders for the million-dollar extension to the Island filtration plant until Jan. 30, after receiving an application for extension of time on behalf of the Pulsometer Engineering Co., London, England.

Winnipeg, Man.— Tenders addressed to the Chairman, Board of Control, will be received at the office of the undersigned up to Friday, February 20th, for the supply of Overhead Construction and Line Materials required by the City Light and Power Department during the year 1914.

Assiniboia, Man.—Tenders will be received by the undersigned up to 4 o'clock p.m., on Monday, the second day of February, 1914, for the supplying and erection of a plate girder bridge with concrete floor across Sturgeon Creek, on Saskatchewan avenue. Length of bridge is to be 35 feet, and the width 20 feet. Plans and specifications may be seen at the office of the Municipal Engineer, at the Municipal Hall, St. Charles, Man.

Lacombe, Alta.—Tenders addressed to the undersigned and endorsed Tenders for Railway Construction, will be received until Saturday, January 31, for construction of about 15 miles of the Lacombe and Blind Man Valley Electric Railway between Lacombe and Bentley, Alta. Plans, forms of tender, specifications and all other information may be obtained from Farncombe and Inkster, Engineers, Edmonton South, or from M. N. McPhee, Engineer in charge, Bentley, Alta.

Marine

Vancouver, B.C.—A company headed by Ex-Ald. J. D. McNeill has purchased a water frontage on False Creek, and tenders will be called immediately for the construction of a dock. The land will be developed for industrial and shipping purposes.

Sarnia, Ont.—It is reported that the LeBel Lumber Co. is bargaining for another lumber steamer, to take the place of the Lillie Smith, sold last fall.

Port Dover, Ont.—It is understood that the Government estimates will contain a generous sum for the Port Dover Harbor. Port Dover is terminus of the new Lake Erie and Northern Railway, which will soon connect Galt, Brantford and Simcoe with Lake Erie.

Contracts Awarded

Guelph, Ont.—The Guelph Radial Railway Board has awarded a contract to the Preston Car and Coach Co. for two new street cars.

St. Thomas, Ont.—The general contract has been awarded for the erection of a new Y. M. C. A. building to A. E. Ponsord of St. Thomas.

Toronto, Ont.—The tender of John T. Hepburn, Toronto, for a travelling crane for the main pumping station was accepted by the controllers.

Calgary, Alta.—The city council has awarded the contract for a 1,000 k.w. synchronous motor generator and exciter set to the General Supplies, Ltd., at $18,250.

Yorkton, Sask.—The Boving Co. of Canada, Ltd., has secured the contract for the supply and delivery of one 500 b.h.p. combined unit Diesel required by the town council.

Ottawa, Ont.—The Government has awarded a contract to Jennings & Ross, Ltd., for the construction of a dam at the head of Big Chaudiere, French River. The contract price was $23,124.40. A contract was also awarded to William Dewar for the construction of an extension to a wharf at Gull Harbor, Man.

Substation Apparatus and Car Equipment.—The Toronto Suburban Rly. Co. has just closed a contract with the Canadian General Electric Co. for substation apparatus and car equipments, for the new line which will run west from Toronto through Georgetown, Guelph and Berlin. A very interesting feature is that this will be the first interurban line in Canada to operate at 1,500 volts direct current. The catenary type of overhead construction will be used, and there will be three substations at Islington, Georgetown and Guelph respectively. Rotary converters of 1,500 volt, 500 k.w. capacity each will be used, power being transmitted to the substations at 25,000 volts. Provision will also be made for the supply of power from a separate bank of transformers in each substation for distribution along the line for mis-

cellaneous power and lighting purposes. The cars will be equipped with four 85 h.p. motors of the latest type; fully ventilated and the control will be of the multiple unit type to permit of train operation. These cars will operate on a 600 volt line at approximately half normal speed, and changing from 1,500 volt to 600 volt trolley or vice-versa will involve no loss of time whatever in adjustment of control apparatus. The line with 1,500 volt operation will be about 62 miles long.

Refrigeration

Saskatoon, Sask.—W. B. Neil, ex-industrial commissioner, is proposing to start a meat packing plant.

Richmond, Que.—The Board of Trade have appointed a committee to secure data regarding the establishment of a central cold storage plant in the Eastern Townships.

London, Ont.—The plant being erected by the London Cold Storage Co., to manufacture ice is nearing completion. The system of freezing being installed was decided upon after much consideration, and the plant when finished will be one of the best on this continent.

Fort William, Ont.—The Armour Packing Co., Chicago, are looking for a site in Fort William. A representative, said to be the superintendent of agencies, has looked over various locations. Until the Company can erect their own cold storage plant, they are looking for a temporary location with cold storage facilities.

Railways—Bridges

Sarnia, Ont.—The Sarnia Street Railway, it is said, is contemplating extensions.

Montreal, Que.—The Montreal Tramways Co. will put 25 new cars and 25 trailers into service.

Welland, Ont.—The Niagara, Welland and Lake Erie Railway is preparing to build an extension to Dain City.

Toronto, Ont.—Works Commissioner Harris has reported that it is possible to construct a bridge over the railway tracks on line of Morrow Avenue. The estimated cost would be $131,807.

Brantford, Ont.—W .P. Kellett, if he secures control of the street railway, will put in new rolling stock, and reconstruct the road.

London, Ont.—Engineers in the employ of the Ontario Hydro-Electric Commission are preparing a survey for the proposed hydro radial between London, St. Mary's and Stratford.

Fort Erie, Ont.—The Canadian Boulevard Commission will build a trolley line from Niagara Falls to the proposed terminal at Fort Erie, and have it in operation inside of two years.

Toronto, Ont.—Commissioner Harris has presented plans for the new Gerrard Street bridge to the Board of Control, to cost $382,000. He recommended the highest tender, because it would give a 66-foot width and carry 40-foot cars.

Toronto, Ont.—The residents of Humber Bay and the southern portion of Etobicoke Township are urging the city to construct an electric line along Queen street from the Lake Shore road, in order to give them more rapid transportation into the city.

Montreal, Que.—Laprairie, Que., will apply to the Dominion Railway Commission for an order to build an over-head construction on Victoria bridge for the trolley cars, on the ground that space on the bridge at the disposal of vehicles is too small.

London, Ont.—The offer of the Michigan Central Railway to loan its gangs to the city for the reconstruction of the London and Port Stanley Railway will be taken advantage of, and work will be undertaken in the spring. Electric trains will be operated between this city and the lake not later than September.

Toronto, Ont.—The Toronto & Suburban Railway Co., having refused to construct a trolley line on Jane street from Bloor to Annette street, and along Bloor street, the city is now free to build this line. The city council six months ago approved a recommendation of the city engineer to require the railway Company to build the line.

Sarnia, Ont.—Initial steps are being taken towards the construction of the proposed hydro-electric railroad line from Sarnia to London. The style of construction will be known as the heavy electric with solid roadbed, and the passenger traffic will be handled by cars similar to those on interurban lines in Michigan.

Montreal, Que.—It is expected that in a few weeks the Dominion Railway Commission will be petitioned to approve plans for the elevation of the Grand Trunk tracks between Cote St. Paul Road and Bonaventure station and St. Henri Station and Wellington street. This will embrace the building of nearly five miles of viaduct at an estimated cost of $5,500,000 and the construction of nineteen subways. The G. T. R. will build a new station at St. Henri, and a new Bonaventure Station at a cost of from a million to two million dollars.

Trade Gossip

Ottawa, Ont.—The Ottawa Car Works have been purchasing machine tools for extra large work

Merritton, Ont., will shortly have a by-law compelling its manufacturers to use smoke consumers.

The Lafrance Improved Pipe Joints Co. Ltd., Montreal, have changed their name to Fittings Foundry, Ltd.

Roxton Pond, Que.—The Roxton Tool and Mill Co. Ltd., has increased its capital from $100,000 to $300,000.

T. C. Norris, leader of the Opposition in the Manitoba Legislature, last week moved a resolution that agricultural implements from the United States be admitted free of duty.

C. M. Power, general sales manager of the Standard Chain Co., Pittsburg, was in Montreal last week to confer with Alex. Gibb, general sales agent for Canada, St. Nicholas Building, Montreal.

The Montreal Motor Show will be held during the last week of January and the first week in February in the Drill Hall, Craig street. The second week will be devoted to motor trucks and business vehicles.

C. J. Garry, general manager of the International Marine Signal Co., Ottawa, says the rumor that his Company is going out of business is untrue, and that the plant is closed down to allow of reorganization.

Goold-Shapley & Muir Co., Brantford, Ont., held their twenty-first annual meeting last Saturday afternoon. E. L. Goold, president, read the annual report, and announced a turnover of $40,000 larger than that of the previous year.

The Massey-Harris Co.'s agents in Hamilton district held a banquent at the Waldorf Hotel, on Jan. 16. R. Armitage, the company's representative in Hamilton, was presented during the evening with a pair of oak chairs.

Welland, Ont.—The Canadian Steel Foundries plant has resumed active manufacturing operations. The foundry is now working six days a week instead of only three, and the rolling mill is gradually giving employment to more men. It is expected that the entire plant will be running full again within a short time.

S. Samuel, of M. & L. Samuel, Benjamin & Co., Toronto, leaves this week for Europe, where he will remain for a number of years. G. T. Pepall, who has been associated with the firm for twenty-two years, will manage the business. This is one of the oldest established metal firms in Canada, having commenced operations here in 1855.

The Western Drydock and Shipbuilding Co., Port Arthur, Ont., received a cheque last week from the city, for $25,000, being the yearly bonus given since their establishment. The Company guaranteed to employ 300 men for 300 days per year. It now employs 728 men for 300 days, and its yearly payroll is $500,000.

The A. R. Williams Machinery Co., whose machine tool agencies have undergone considerable change recently, have secured the exclusive Canadian agency for the R. K. LeBlond Machine Tool Co., Cincinnati, O. They have also secured the exclusive agency for Dreses Radial Drills, manufactured by the Dreses Tool Co., Cincinnati.

The Port Arthur Board of Trade asked Winnipeg City Council to support a proposition advocating that the Dominion Government grant a bonus of fifty cents on each ton of Canadian iron ore mined and smelted during the next ten years, providing that the bonus in the aggregate should not exceed one million dollars in any one year of such period. The council decided not to support the proposition.

Sheldon's, Ltd., Galt, Ont., have recently made the following sales:—Heating and ventilating equipments for the Dominion Bank, New Technical School, Marcus Loewe's Theatre, civic car barn and Children's Hospital, all in Toronto; the Laurentide Pulp Co., Grandmere, P.Q.; the Abitibi Pulp and Paper Co.; Iroquois Falls, Ont.; the Provincial Jails at Victoria and Burnaby, B.C.; the C. P. R. shops on North Bay, Ont.; the J. H. Still Mfg. Co., St. Thomas, Ont., and a Public school at Saskatoon, Sask.

New Automobile Factory.—A St. John, N.B. despatch says that New York capitalists have leased a site adjoining the Ford Motor Co. property at Coldbrook, three miles from that city, and the Dominion Motor Car Co., Ltd., announce that they will erect an automobile manufactory and also start a brick-making industry. The names mentioned are H. M. Kilburn, of the National City Bank, New York; P. A. Rockefeller, J. H. Flagler, and two prominent directors of an American automobile factory, John A. Graham and Leslie F. Bond.

John Bertram & Sons, Dundas, Ont., held the sixth annual entertainment under the auspices of the employees' mutual benefit association in the Music Hall on the evening of Jan. 15. About 250 were present. The association gives this entertainment free every year to its members, charges its members a fee of 40 cents per month, and pays a sick benefit of $4 per week, with a limit of 18 weeks. Whenever the general fund amounts to $300 a monthly assessment is cancelled. This happened three times in the last year.

The British Columbia Marine Railway Co., Esquimalt, B.C., whose shipyards have been sold to Yarrow & Co., Glasgow, was founded in 1893 by W. Fitzherbert Bullen, president, who came from London, Ont. H. F. Bullen, managing director, is a native of the same city. George Gordon Bushby is a director, and manager of the Vancouver branch. Douglas B. F. Bullen, secretary-treasurer, is a son of the president. They retain their interest in the B.C. Salvage Co., and the Vancouver branch of the B.C. Railway Co.

Personal

James Collins Miller, M.A., B.Sc., Ph.D., has been appointed Director of Technical Education for the Province of Alberta.

Mount Royal Tunnel, The Canadian Northern Railway

By J. C. K. Stuart*

The author deals in an interesting and comprehensive manner with this great undertaking, with which he has been connected from its commencement. The preliminary heading through the heart of the Mountain was completed on December 10, 1913, and work on the enlarging of the bore is now going rapidly forward. The various methods to be adopted in lining different sections of the tunnel are of considerable interest.—Editor.

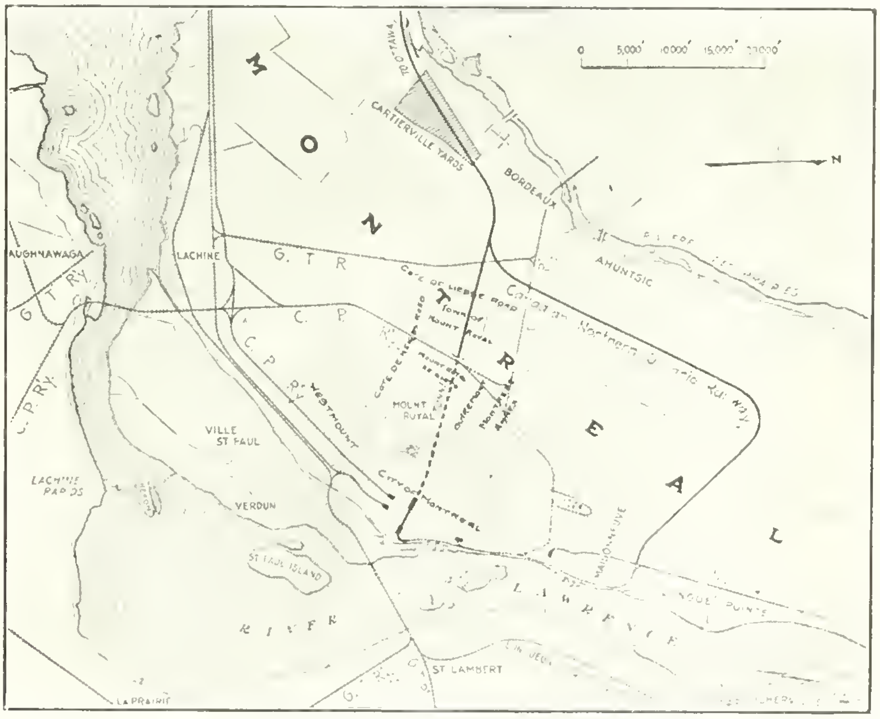
THE Canadian Northern will become a complete Transcontinental railway about September, 1914, when the Canadian Northern Pacific from Edmonton to the Pacific Coast and the Canadian Northern Ontario from Montreal to Port Arthur will be ready for operation.

The Montreal tunnel and terminal of this new Transcontinental is the largest work of the kind that has ever been undertaken in Canada. The railway and general situation in and around Montreal is clearly shown in the map, and the manner in which the city has expanded along the St. Lawrence River and out around the lower slopes of Mount Royal can readily be seen. This expansion has taken place in three directions only; Mount Royal forming a natural barrier to rapid extension in the fourth direction.

To enter the city from the west in a similar manner to the Grand Trunk and Canadian Pacific Railways would have entailed the enormous expense of a right-of-way through thickly populated and valuable property, with numerous street crossings and many other disadvantages, while the railway can easily be brought to the back of Mount Royal, to within three miles of the centre of Montreal, over a comparatively cheap right-of-way and by a tunnel through the mountain into the heart of the city.

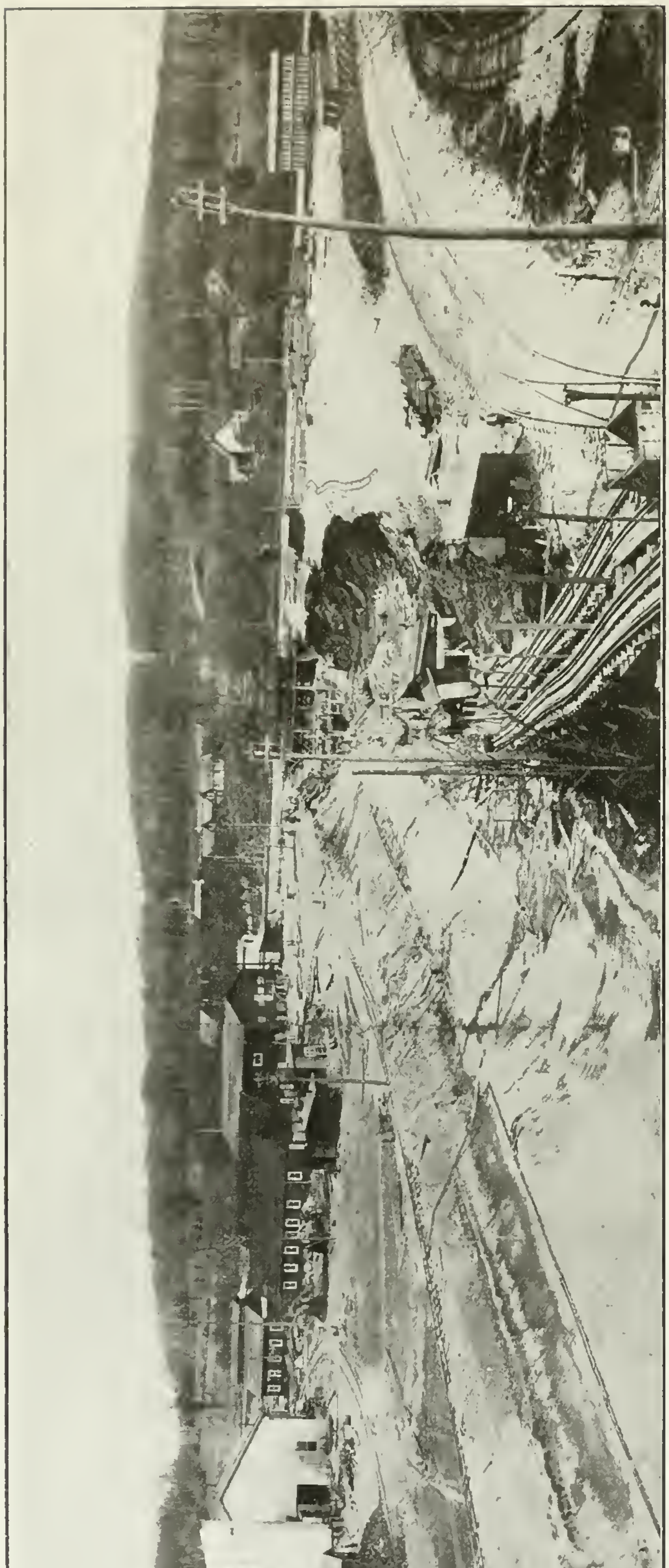
Large tracts of farm land were bought, extending from the lower slopes of Mount Royal to the Riviere des Prairies, or Back River. A portion of this land, consisting of about 1,200 acres, was subdivided and incorporated as the Town of Mount Royal; more commonly known as "The Model City." The

*First Asst. Engineer, the Mount Royal Tunnel & Terminal Co., Ltd.



MAP OF C.N.R. TERMINAL LINES AT MONTREAL, SHOWING THE NEW LINE WITH TUNNEL UNDER MONTREAL TO A CENTRAL PASSENGER STATION

PLAN AND PROFILE OF THE MOUNT ROYAL TUNNEL



GENERAL PANORAMA, WEST PORTAL, MOUNT ROYAL TUNNEL
THE CANADIAN NORTHERN RAILWAY MONTREAL

railway will bring this land to within ten minutes of the middle of the city; so it is expected that it will more than pay for the tunnel and terminal.

The railway crosses on to the Island of Montreal near its western end, and follows the south shore of the Riviere des Prairies to Cartierville yard. This yard will be for the storage and sorting of freight, and will have adequate shops and auxiliaries to serve the terminal. It will also be the point of transfer from steam to electric traction, as the tunnel and terminal will all be operated electrically. From the Cartierville yard, the railway runs in an easterly direction across the Cote des Neiges Road, thence southerly across the Jacques Cartier Union Railway (G.T.R.) at grade, and through the new town of Mount Royal, the tracks being depressed sufficiently to allow the streets to be carried over them.

About 400 feet from the southern boundary of the Model City, the line curves a little to the east, and passes through the western portal of the tunnel, which will be on the north side of the C.P.R. (Belt Line) right-of-way. From the portal the line leads straight under the new subdivision (Mount Royal Heights), part of the town of Outremont, and Mount Royal itself, to a point under the McGill University campus. Thence, curving to the west it comes down McGill College avenue to Cathcart street and into the passenger station, which is bounded by Cathcart and Lagauchetiere streets, Ste. Monique and Mansfield streets.

A glance at the profile illustration shows clearly the difference of elevation, amounting to about 72 feet, in the two levels of the city. The upper level comprises the shopping, hotel and residential districts, and the lower the wholesale and financial districts. The tracks in the passenger station will be about 50 feet below the upper level, and, from this station, the railway will run on a viaduct about 22 feet above the lower level to the river front, to connect with the Harbor Commissioners' proposed viaduct. This will give a connection to all the harbor facilities, the Canadian Northern Steamships and the Canadian Northern Quebec Railway at the east end of the city. As a part of the proposed viaduct across the lower level of the city there will be an elevated freight station in the centre of the commercial district for the receipt and delivery of local freight.

The tunnel is 3¼ miles long and descends on a six-tenths of one per cent. grade from the West Portal to the Terminal Station. It is designed for two tracks in two separate tubes. There will be a station at the centre of the Town of Mount Royal and another sta-

tion at the West Portal, with platforms extending under the C.P.R. tracks, forming an underground station for Mount Royal Heights. Multiple unit trains will run on a three-minute schedule within the electric zone to carry passengers from Cartierville, Mount Royal and Mount Royal Heights into and out of the city, thus bringing the latter two within seven minutes of the main station at Dorchester street. If elevated stations are built at the crossings of St. James, St. Antoine and Notre Dame streets, these two new subdivisions will be within ten or twelve minutes of the financial and commercial district.

The passenger station will have sufficient length of platform to accommodate the longest Transcontinental trains, and enough tracks will be provided to take care of, and separate the express and commuter traffic. The tracks being below the street level, the surface will be available for station and office buildings and it is expected that the terminal development will be self-supporting aside from the railway business. The platforms will be readily accessible by ramps from the upper level, and a driveway from the lower level. High platforms have been adopted,—that is to say, the platforms will be level with the floors of the cars, which will facilitate the handling of passengers during the rush hours.

Heading Progress.

Mount Royal is supposed to be an extinct volcano, but it is doubtful if it ever was active, though it is the remains of a volcanic upheaval of igneous rock. There have evidently been several stages of upheaval, as both the limestone and the main igneous body of Essexite are broken and cut by a great many dikes of quite different character and probably of later origin.

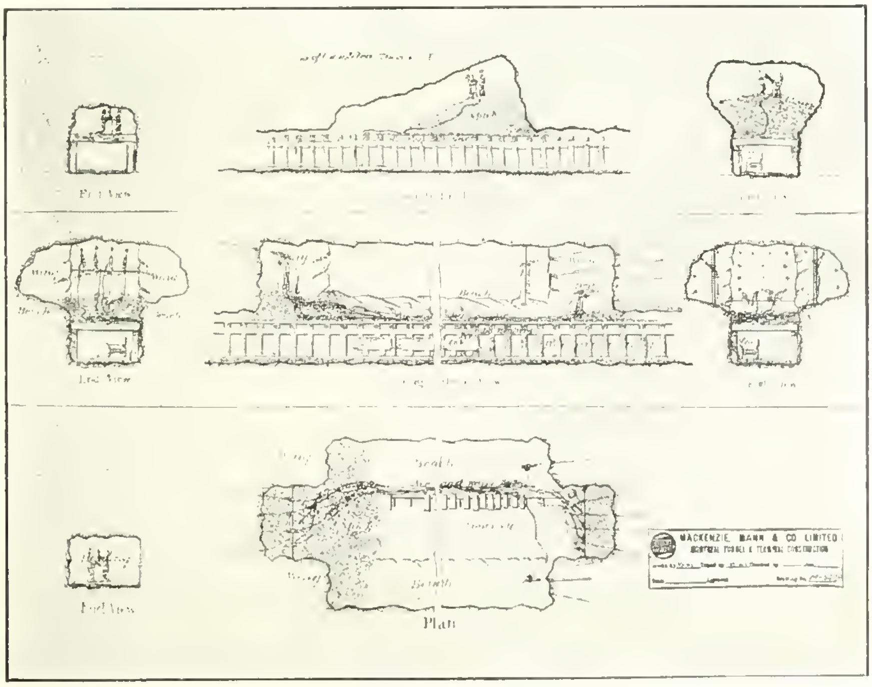
A limestone of various degrees of hardness was the first rock to be met with; then, as the headings progressed dykes of quite different character and Bostonite, Camptonite and Syenite were encountered and a volcanic breccia, which was extremely blocky to drill and shoot. The heart of the mountain is Essexite, a very hard and tough rock.

The method of excavation adopted was the bottom centre heading, as this method allows the heading to be driven forward as rapidly as possible, without much regard for the character of the ground, and the full-sized excavation can be developed simultaneously in as many places as desired. The headings were driven large enough to permit the use of a double-track 3-ft. gauge railway through the "break-ups."

DRILLERS WORKING AT FACE OF HEADING.

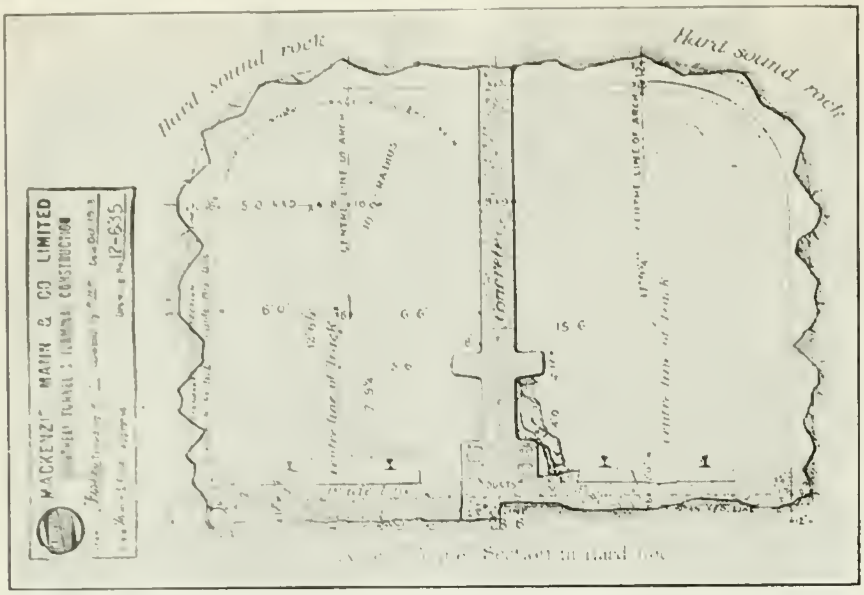
Work was commenced at the west end of the tunnel in May, 1912. An open cut was made down to the tunnel level and a bottom centre heading, 8 feet high by 12 feet wide, was started in July. This heading was driven in about 200 feet, through boulder clay, when ordinary crystalline limestone was struck. A shaft 240 feet deep was sunk near Maplewood avenue, about a mile from the West Portal, and headings were started, one west to meet the heading from the West Portal, and another east towards the city. At the city end, a shaft 55 feet deep was sunk near the corner of Dorchester and Ste. Monique streets, and a heading driven up under McGill College Avenue, and westward. The headings driving east from the West Portal and west from the Maplewood shaft met on April 5, 1913, and the headings east from the Maplewood shaft and west from the Dorchester shaft met on December 10, 1913.

The character of the rock has had a very great influence on the progress of the headings. The heading driven east from the West Portal was in limestone for the first 1,500 feet. As the men became more familiar with the methods of excavation adopted the progress in-



BREAK-UP PROCEDURE.

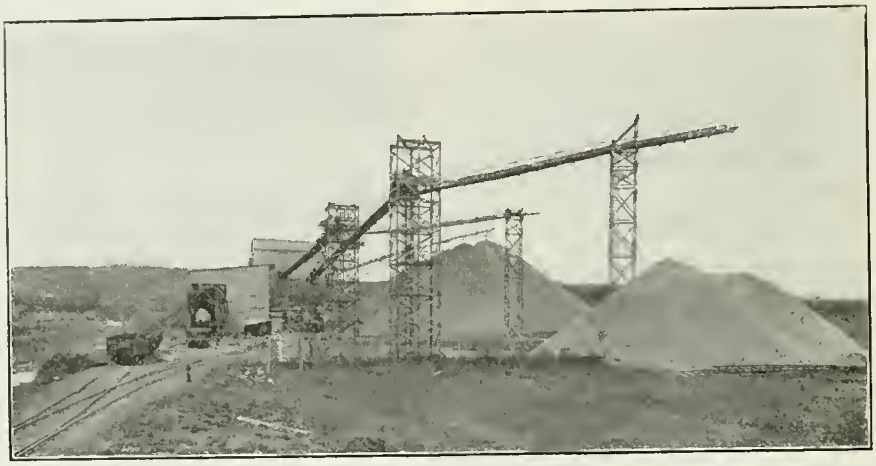
creased to about 22 feet per day, but when the breccia was encountered, the progress dropped to 9 to 12 feet per day.



TUNNEL CROSS SECTION IN HARD, SOUND ROCK, REQUIRING NO LINING.

In the 10 ft. x 12.5 ft. heading driving east from the Maplewood shaft the progress averaged 343 feet per month from Dec. 1st, 1912, to March 31st, 1913, the greatest monthly progress in this period being 408 feet in December, 1912. The heading started from the shaft in November, 1912, in hard crystalline limestone, and as it advanced the rock became harder until the solid Essexite was encountered in January, 1913, when progress dropped to about 12 feet per day. The muck-handling drill carriage was installed in the following April, and the monthly progress increased to an average of 477 feet from May 1st to November 30, 1913, the greatest monthly progress in this heading being 510 feet in May.

At the city end, before the limestone became very hard and crystalline, the progress averaged about 20 feet per day, and during the month of April the heading advanced 507 feet. In May 810 feet of 8 ft x 10 ft heading was driven in 31 working days, and this is considered to be a new record in hard rock tunneling. At the beginning of May the heading was in crystalline limestone, but about the 20th of the month a good many dykes of hard trap rock were encountered, which reduced the progress considerably. About fifteen months elapsed between the start and completion of the heading in the tunnel proper. The heading is about 16,500 feet in length, and approximately 68,000 cubic yards of rock have been excavated from it.

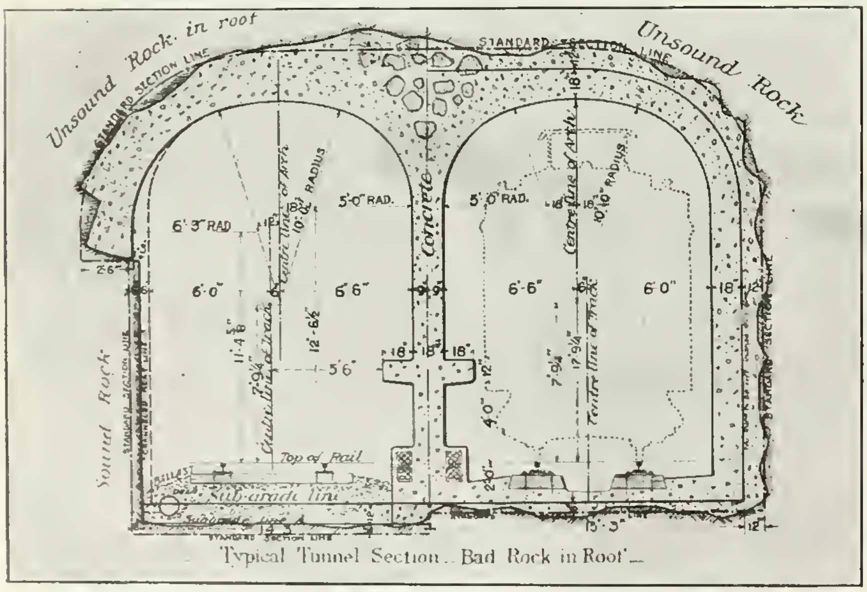


CRUSHER PLANT AND DISTRIBUTING SYSTEM, WEST PORTAL.

Break-Up Excavation.

In January, 1913, the "break-ups" were started at the west end. The break-ups, i.e., the excavation of the upper part of the tunnel section to its full width and height, are opened at intervals of from 500 to 800 feet along the centre bottom heading. As many break-ups are opened as is possible, the number depending for economy on the amount and efficiency of the transportation plant. Speaking theoretically, as many break-ups may be opened as are necessary to keep pace with the heading progress, the advance in each break-up being about half that in the heading.

The roof of the heading is drilled and blasted down on to the track until there is sufficient room for the men to work above the heading. Jumbo timbers are then framed into the heading and planked over, forming a timber floor for the break-up and a timber roof for the heading. The break-ups are advanced by carrying an entry in both directions, the same width as the heading and the full height of the roof, about 15 feet ahead of the wing wall excavation. Four drills, mounted on a horizontal bar, are used in the entry. One drill mounted on a column is used in each wing. The six drills do all the drilling in both ends of the break-up, and two drilling shifts of



TYPICAL TUNNEL SECTION—BAD ROCK IN ROOF.

8 hours each break all the ground that three mucking shifts of 8 hours each can economically handle. When the drilling in the entry and wings is finished the entry and wings are shot together; and while mucking is going on, the drills are set up in the other end of the break-up. The rock is all blasted down on to the timber floor. Cars are spotted underneath and the muck run directly into them through holes in the timber floor. This method makes the handling of the muck very cheap and rapid; and very little blasting powder is required as the rock is always breaking to two faces.

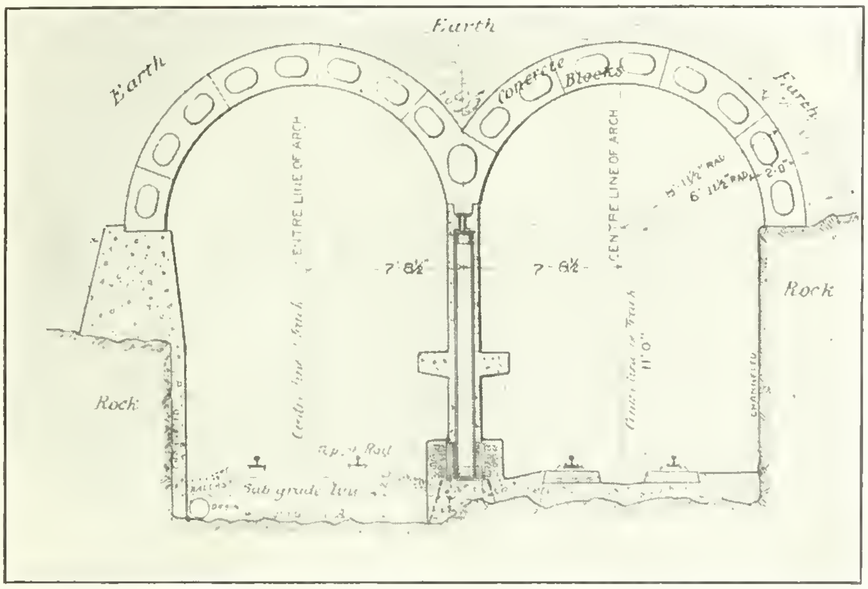
Approximately 97,000 cubic yards, or about 40 per cent. of the break-up excavation was completed during 1913, and it is expected that it will all be finished by May, 1914.

Bench Excavation.

After the break-ups are completed, the two side benches will be taken out by a steam shovel operated by compressed air. The benches will be drilled and blasted well in advance of the shovel and by using a specially designed boom, and dumping on to conveyors to carry the muck back to cars, very little time will be lost by the shovel.

Shield Work.

At the city end, where the floor and sides of the tunnel are in rock and the roof in earth, a roof shield will be used for the excavation, thus eliminating heavy and expensive timber work. The shield consists of a cutting edge, shaped to the outline of the tunnel roof cross section, forming the front of a steel envelope, extending over the platform on which the men work, and back far enough to lap over the last ring or section of tunnel being erected. The shield is supported on steel columns forming the centre wall and on side walls which rest on the solid rock. It is forced ahead by hydraulic jacks under a pressure of about 5,000 lbs. per sq. inch, which work against the tunnel lining as it is erected.



TUNNEL CROSS SECTION IN SOFT GROUND REQUIRING SHIELD. O'ROURKE CONCRETE BLOCK LININGS.

Tunnel Lining.

The tunnel lining will consist of concrete blocks weighing about two tons each, cast in large cast-iron forms and allowed to set in the yard for at least a month. These blocks are cast with two large tenons on one side and two recesses for the tenons on the other side, so that each block will lock firmly into the two adjoining blocks of the preceding ring. In this way no forms are required, and after a ring of blocks has been erected under the hood of the shield the jacks can force the shield ahead, as the excavation advances, until there is room to erect another ring of blocks, a space of about 27 inches being required.

The blocks are so designed that the extrados of the arch is continuous, but the joints in the intrados are about 1¼ inches wide. These joints are held to shape primarily by three part wedges, and later filled with concrete by means of a cement gun. The blocks will be handled into place by means of two hydraulic erectors on the shield itself. These blocks were invented and patented by John F. O'Rourke, a contractor of note in New York.

Pneumatic Concrete Lining.

Where the shield or other special construction is not used, it is proposed to try out the mixing and placing of concrete for the lining by compressed air. All forms will be collapsible and movable so that they may be used repeatedly. The concrete will be conveyed from the pneumatic mixer to the forms through pipes by compressed air. If this method is successful, it should be very rapid and economical.

Tunnel Cross Sections.

The twin tube tunnel section was adopted for three reasons:

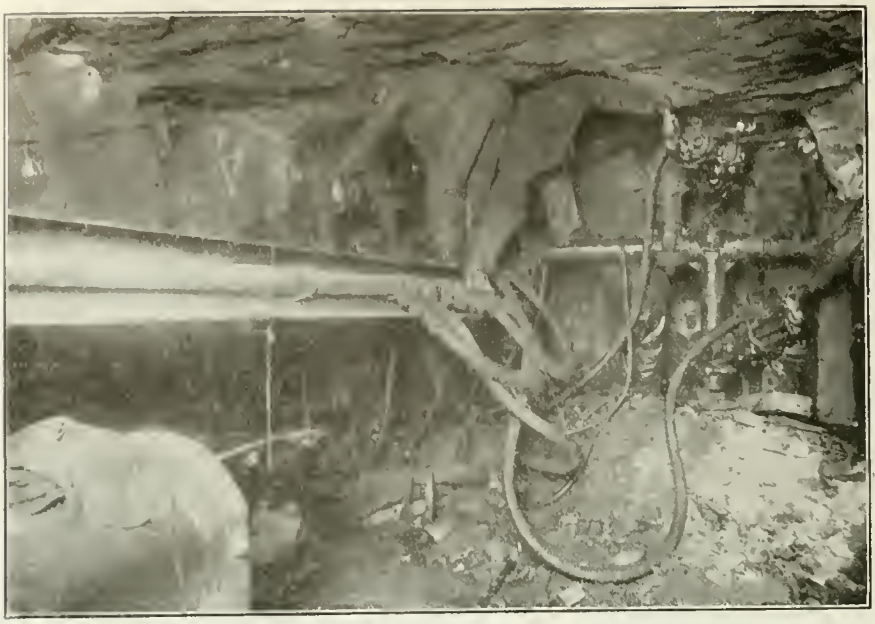
Economy in Construction.
Ventilation.
Safety of Operation.

VIEW OF A BREAK-UP, SHOWING TIMBERED HEADING BELOW.

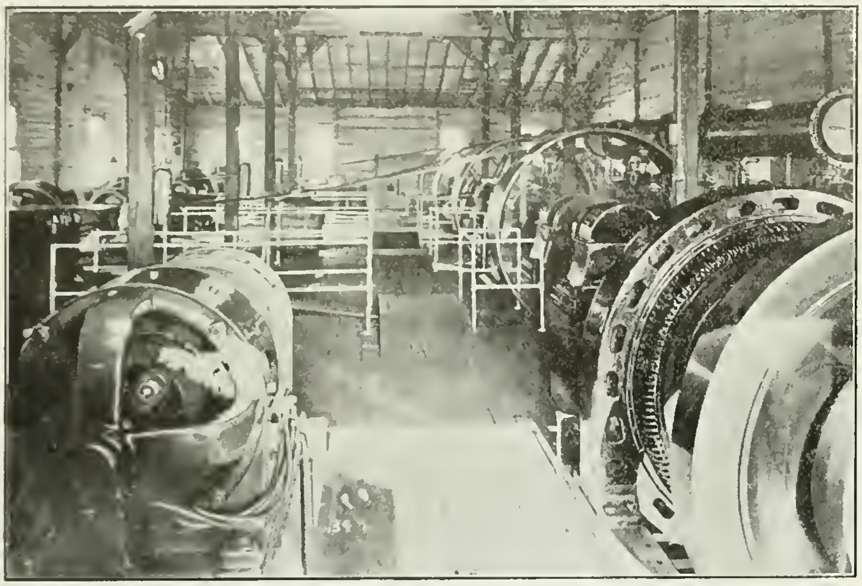
Economy in Construction.—It was found that in soft ground the amount of both excavation and masonry could be reduced by adopting the twin section. The geological formation indicates that a great portion of the tunnel will not need to be lined and that a concrete centre wall will sufficiently reinforce the natural flat rock roof.

Ventilation.—It is well-known that a twin tunnel with all the trains in each tube moving in a constant direction will be better ventilated than a double track tunnel, where passing trains merely tend to stir up the air without causing a continuous movement in one direction. The cross-section of each tube is so proportioned that the relation of train area to tube area will help ventilation without producing excessive compression, which would retard the speed of trains and be objectionable to passengers.

Since the headings have been "holed" and the air has been given clear passage through Mount Royal, there is a continuous current through the heading, its direction depending on the temperature outside.



FRONT END OF MUCK-HANDLING DRILL CARRIAGE.



INTERIOR OF COMPRESSOR HOUSE, WEST PORTAL.

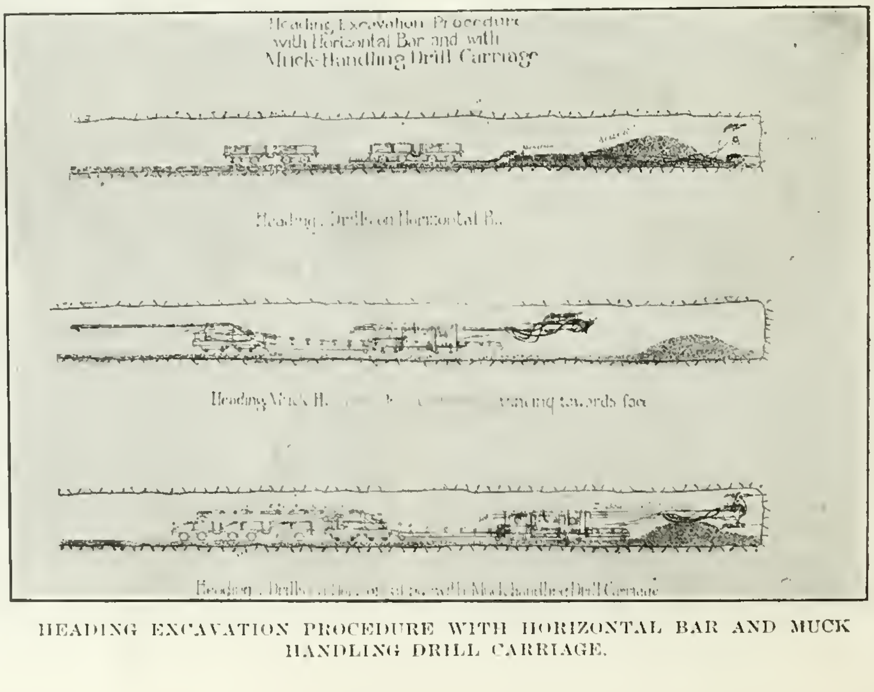
Safety in Operation.—The centre wall is particularly valuable in case of derailment or accident, as it confines the wrecked train to one track and leaves the other clear. The walkway at about the level of the platforms will allow passengers to get out of the cars in case of stoppage and walk to the nearest cross-passage and enter the other tube.

Underneath the walkway is a continuous refuge niche, except at splicing chambers, where trackmen may sit on the duct bench at the bottom of the centre wall and so be protected from passing trains. Large refuge niches will be built at intervals for the accommodation of hand cars and repair equipment during hours of train operation. The high headroom was adopted to allow room for a high voltage trolley, and the 3-centered arch to allow for the sway of the pantograph and because the stratification of the rock lends itself peculiarly to a flat roof.

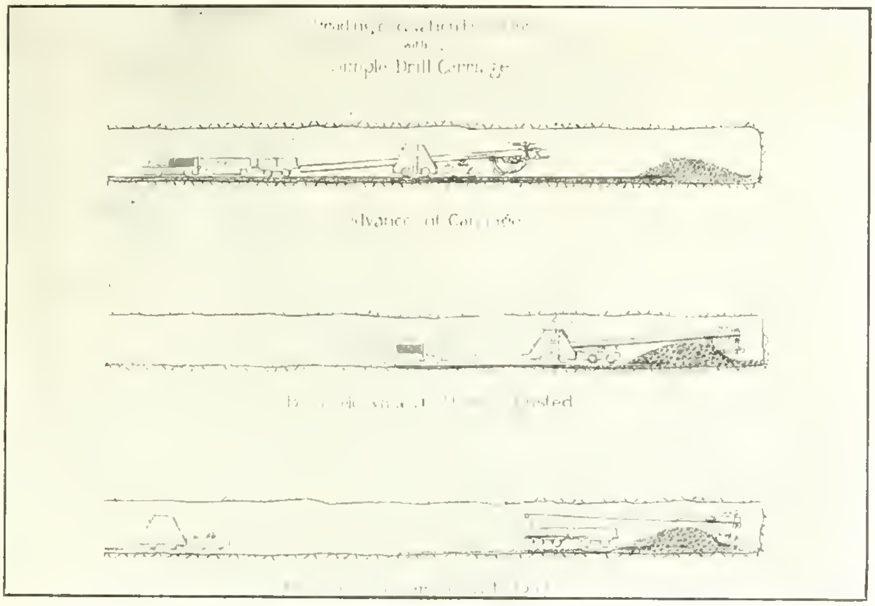
The cross-section may vary materially in certain details, owing to local conditions. The concrete blocks and shield will only be used on the city end, where, in some few cases, flat roof construction may be adopted. Where the tunnel is all in rock and the sides are solid, but the roof bad, a single arch may be adopted, the centre wall being built up to the level of the walkway and provision made for constructing the remainder up to the arch roof, should the ventilation demand it.

Construction Plant.

All the rock excavated in the tunnel is being crushed for road material and concrete stone. What is not required by the company is sold in and around Montreal.



HEADING EXCAVATION PROCEDURE WITH HORIZONTAL BAR AND MUCK HANDLING DRILL CARRIAGE.



HEADING EXCAVATION PROCEDURE WITH SIMPLE DRILL CARRIAGE.

Air Compressor Plant.

Compressed air is used to operate the drills, pumps, tipples, etc.; in fact, everything that is not operated electrically. There are two plants, located one at each end of the tunnel, with a total capacity of 11,000 cu. feet of free air per minute, compressed to 100 lbs. per sq. inch.

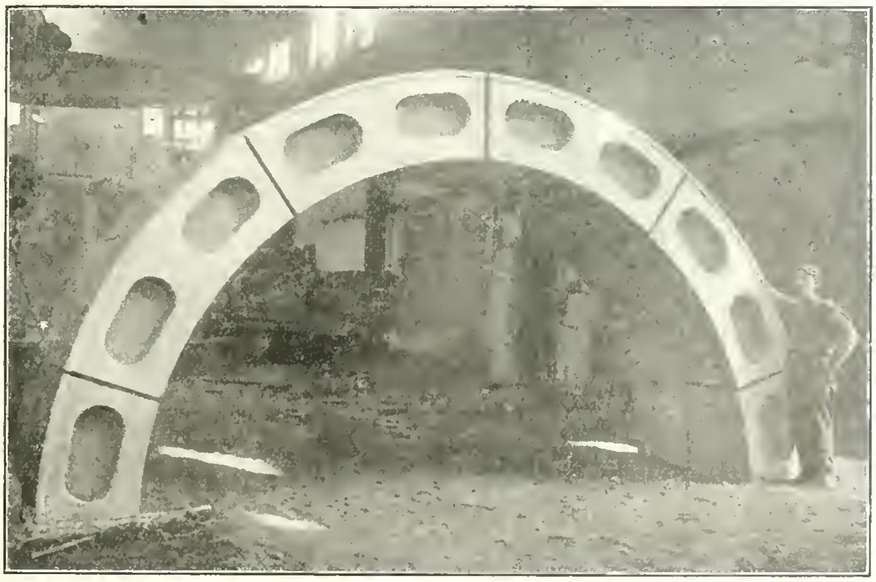
These plants consist of eight cross-compound compressors. Six of these are Blaisdell compressors of 1,100 cubic feet capacity each, belt-driven from 225 H.P. motors. The other two are Sullivan compressors direct connected to 400 H.P. motors, and of 2,200 cubic capacity each. Power is purchased from the Montreal Light, Heat & Power Co. at 2,400 volts, 60 cycles.

Well equipped machine, carpenter and blacksmith shops were built at the West Portal, so that the company would be independent of local shops for repairs.

The main crusher plant at the West Portal, consists of two No. 7½ and one No. 4, Kennedy gyratory crushers, with Stevens Adamson elevators, conveyors and screens. The capacity is about 1,500 cubic yards per day.

The tunnel muck is hoisted in cars up an incline from the tunnel grade to the tipples above the two crushers. After the cars are dumped, they return by gravity to the tunnel level. The crushed rock is elevated to a revolving screen, which sorts it into various sizes and distributes it into bins. Cars can be run directly under the bins and loaded in a short time, and there is rail connection with both the C.P.R. and G.T.R. The excess of sorted stone is conveyed to stock piles and loaded as required by a locomotive crane with clam shell bucket. At the city end the tunnel muck is sold to, and crushed by, an outside company.

REAR END OF SIMPLE DRILL CARRIAGE, BEAM IN PLACE AND CARS READY TO LOAD.



O'ROURKE CONCRETE BLOCK ARCH SET UP IN SHOP

All the tunnel muck cars, the two drill carriages and two electric tunnel locomotives were built in these shops and several tunnel locomotives were converted from gasoline to electric storage battery. There are three Ward drill sharpeners, one at the east end, one at the west end, and one at the Maplewood shaft.

Transportation Plant.

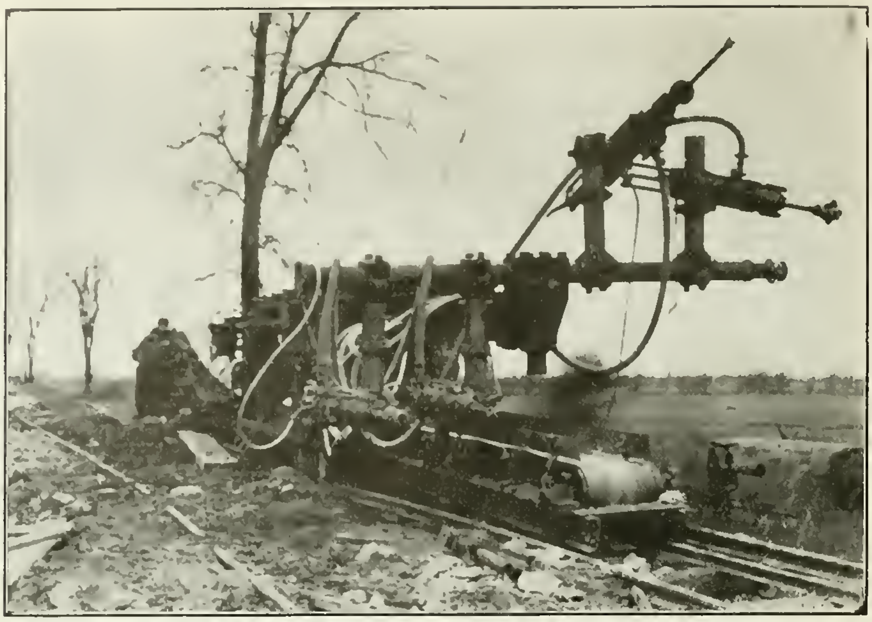
The transportation plant consists of one 30-ton American saddle tank locomotive, standard gauge, for use in the yard; two G.E. 10-ton trolley locomotives, one G.E. 5-ton trolley locomotive; one converted 5-ton trolley locomotive; five 5-ton storage battery locomotives; two home-made 8-ton trolley locomotives, 215 tunnel cars of all types, all of 3-ft. gauge. There is the usual equipment of derricks and hoisting engines, together with one Browning 45-ton, 8-wheel locomotive crane; two Lidgerwood mine

hoists equipped with Eagle Iron Works automatic dumping shaft cages. There are also two gasoline motor trucks, one being a $7\frac{1}{2}$-ton Commer and the other a 2-ton Alco.

Drilling Equipment.

The main drilling equipment consists of Sullivan reciprocating drills, fitted with a water attachment for hollow steel. There are three different sizes; FF 12, of $2\frac{5}{8}$ inches dia.; FL 12, of $3\frac{1}{4}$ inches dia.; U.H. 2, of $3\frac{5}{8}$ inches dia. The best light hammer drill being used is the Hardy Simplex. It is a 25-lb. self-rotating drill that has given most satisfactory service. Most of the drill steel used is F.J.A.B.

Four drills mounted on a horizontal bar were used in the heading. At the beginning of the job in the limestone, the F.F. 12 drills gave good satisfaction, but later, in the Essexite, they were considered too light to use with the ordinary crossbits, and the U.H. 2, $3\frac{5}{8}$-in. and F.L. 12, $3\frac{1}{4}$-in. drills were substituted, with heavier horizontal bars. The $3\frac{5}{8}$-in. drills weigh about 400 lbs. and the horizontal bar with its vertical columns, all the hose attachments, and the four drills, weighs several tons. All this equipment had to be handled in and out of the heading at each shot.



FRONT END OF MUCK-HANDLING DRILL CARRIAGE.

The muck handling drill carriage was designed to do away with this labor. It consisted of an I-beam cantilever, long enough to reach about 20 feet from the carriage over the muck pile, on the front end of which was carried the horizontal bar with all the drills mounted on their short columns and all the hose connections made from the drills to a manifold on the bar. This beam was carried on a heavy frame with two 4-wheel trucks underneath it, and so supported in the frame that it could be given motion transversely, vertically and longitudinally by means of electric motors. Underneath this beam was a continuous belt conveyor that projected out in front of the drill carriage frame far enough to allow the muck to be shovelled on to the belt. The conveyor ran to the rear and was elevated on a second carriage which allowed it to be carried over and dump its muck into cars underneath. A 10-H.P. Dake air motor, located on the second carriage, operated the conveyor.

The carriage was run on a 3-ft. gauge track on the left side of the heading, and as soon as the blasting was finished the muckers started in to clear the track, throwing the muck mostly over to the right side of the heading. When the track was cleared sufficiently (to within 15 to 20 feet of the face), the drill carriage was pushed in by a storage battery locomotive, until the horizontal bar was in the proper position, when it was blocked and jacked out against the sides of the heading. One air hose was connected to the drilling manifold, the other to the conveyor engine and drilling and mucking commenced. When the drilling and mucking were finished, the hose was disconnected, the horizontal bar was released and swung sideways, the carriage pulled back about 300 feet from the face by a locomotive and the blasting begun.

It was found that the drill carriages did not save a very great amount of time in setting up the drills, but they did save a great deal of labor for the drill runners, who were fresher and able to work to better advantage. The weight of the I-beam and the mass of the drill carriage behind it steadied the horizontal bar and helped the drilling progress a great deal. A simplified drill carriage was used in the heading going west from Dorchester Street. This machine had no conveyor for handling the muck from the front of the machine to the cars in the rear. Two trucks were used, coupled together to carry the I-beams, bar, drills, etc. The complete machine was pushed into the heading by a locomotive and the bar swung into position by hand and jacked tight. While the drills were getting ready to start work the trucks were pulled back, the I-beam sliding on the roller on the front truck, until it cleared the rear truck. It was then jacked up to the roof and a gallows frame support placed under it, clear of the track. The trucks were hauled out of the way and the muck cars run in under the beam. When the drilling was completed, the proceedings were reversed and the I-beam and its equipment placed on the

(Continued on Page 112.)

FRONT END OF SIMPLE DRILL CARRIAGE WITH DRILL BAR IN PLACE, JUST PRIOR TO MOVING TRUCKS OUT.

Power Driven Forging and Stamping Plant Improvement

By Wilfrid Spencer

The subject matter of this article consists of an account of a plant which, for a number of years, has occupied the author's attention, and took the form of a paper read recently before the Rugby Engineering Society.

WITH increasing standardization of parts of machines and tools, there had been an increasing need for some process by which parts having the essential properties of forgings could be reproduced in large numbers with an accuracy and neatness of finish. Especially has this been felt in such branches as the making of railway wagon parts, firearms, cutlery, etc.

Drop Forging.

Drop forging or stamping in dies has supplied this need, for it is possible to manufacture identical pieces in large numbers, with great accuracy; and the work turned out possesses the properties of forgings. The result of the adoption of this process has been twofold. In the first place, it has made the standardization of forgings possible, and in the second place, it has led to a perfection of design in some forms of machinery that could never have been reached otherwise.

In the case of motor-car engineering for example, where fewness of the parts is a desirable feature, the necessary complication in the shape of the parts could not have been attained by the old methods of forging, without making the weight excessive. By means of stamping, lightness and strength can be secured together with the needful complexity of form.

Economy of Stamping.

The economy of stamping, especially when large numbers of the same article have to be made, is very marked. In the first place, the stamping can be made very much more cheaply than a corresponding forging, even when the cost of the dies is considered, and secondly, the cost of finishing a stamped article is often very small. By means of stamping, the article can be made more accurately to size than by forging, thus largely reducing the amount of machine work which has to be put in at a later stage, and, in some cases, the finish from the dies is sufficient to obviate the necessity of machining altogether, as in the case of cranks and levers for railway signals, etc.

Brett steam stamps are easily controlled, and have found great favor. They have a large range of sizes from 3 cwt. to 7 tons falling weight. There is, however, one serious criticism that has been made against them—namely, that they are costly in steam consumption. This criticism has been so far warranted in the past that it must be at once admitted that they are not efficient engines, but the defect has been very largely met by an improvement brought out by the firm with which the writer is connected. The stamp has been fitted with a valve gear, the object of which is to cut off the supply of steam at about two-thirds of the stroke, allowing the remainder of the stroke to take place under the expansive action of the steam. The large "blow through" of steam on holding-up is avoided by the use of this gear, and it is estimated that the saving in steam consumption resulting from this and from using the steam expansively is from 25 per cent. to 30 per cent. Besides making the steam drop stamp an economical tool, this automatic expansion valve gear greatly improves the control.

Double-acting Steam Stamps.

Double-acting steam stamps, which were also described by the author, are provided with a piston and piston-rod similar to those of a steam hammer, and steam is admitted alternately to the top and bottom sides of the piston. The pressure of steam on the downstroke allows of a shorter stroke in these stamps compared with those in which the blow is given under the influence of gravity only, and consequently a greater number of blows can be struck in a certain time. In some special cases this is of great importance, enabling the requisite number of blows to be given and the article to be finished, while the maximum of heat still remains in the stamping. These stamps are arranged to give self-acting blows, the intensity of which can be controlled by the foot-lever.

Friction Drop Stamps.

Modern tendencies, however, are in the direction of adopting motor or gas engine drives, instead of steam, and, in an increasing number of workshops, steam boilers have been replaced by electric or gas engine plant. This fact has led hammer makers to design power-driven hammers and stamps. In seeking a power-driven substitute for steam drop stamps, the nicety and ease of control and the large range of size of the latter must be borne in mind. Obviously such tools as the kick stamp and board drop stamp, although of use in certain branches, could not fulfil the uses of a steam drop stamp. The need has been met by a friction-lifter, patented and made for some years by B. & S. Massey, Ltd.

Power.

The nominal weight of the stamp indicates the actual weight of the tup with the smallest die, but the maximum power required and the strength needed in the various parts depend on the weight of the tup with the heaviest die. In cases in which it is necessary to use exceptionally heavy dies, the weight of the tup should be reduced, or the size of the lifter increased, so that the total weight lifted is not greater than the maximum for which the lifter is designed.

When two or more stamps are arranged in a battery driven from one source, it may safely be assumed that the power needed will be less than the sum of the powers for the separate stamps by a percentage depending on the number of the stamps. To obtain the power required, add together the powers for the separate stamps and multiply by a factor, as follows:—

For two stamps, .84; three stamps, .7; four stamps, .58; five stamps, .47.

If, however, by this method of reckoning a higher power be obtained for part of the battery than for the whole of it, then the higher figure should be taken. If higher or lower lifting speeds are required, the power figures must be adjusted accordingly. The average consumption will only be a fraction of the power required for continuous lifting.

Motor Feature.

Motors should be capable of giving at half-hour rating the maximum powers calculated according to instructions above. For any good motor the output on half-hour rating will be from 33 to 55 per cent. larger than that on continuous rating.

Compound wound motors are recommended for driving stamps or hammer, since they run at a lower speed as the load increases, and are able to stand sudden fluctuations of load. They should be arranged to speed up 20 per cent. between the maximum load calculated from the lifting powers given in the table and one-sixth of this load.

Shunt motors may also be used, but they should be 15 per cent. more powerful, as they do not stand fluctuations of load so well. Alternating current motors may be used either of the short-circuited rotor or wound rotor type.

Motors should preferably be of the enclosed ventilated type, as they are subject to the dust of the stamping shop.

Forging Hammers.

Turning to a consideration of forging hammers, we shall find the same causes

at work tending to develop electric or gas driving at the expense of steam, and it will be necessary to mention, in passing, the use of compressed air for hammer driving. The advances made in gas and electric driving have brought compressed air into greater prominence, and it has gained favor with a number of power users.

There are cases in which the use of compressed air in the smithy or forge is right, as, for example, where compressed air is used for other purposes, such as riveting, chipping, and caulking, or where steam would have to be carried such long distances as to be unprofitable, owing to the large condensation losses. These considerations, added to the undoubted advantages of compressed air in working, have led to its substitution for steam in hammer-driving in many cases.

Where such a change has been made, it has sometimes been found possible to retain the steam hammers and drive them by compressed air, but the great objection to air driving is its cost. In most cases the production of compressed air involves an expensive plant which requires a great deal of power to drive. Attempts have been made to use the air economically by means of a number of different systems, but some of these have only met with partial success, while others have involved a complication in design without resulting in economy.

Amongst other systems adopted, attempts have been made to apply the principle of compounding to the case of compressed air. Now the whole reason for adopting compounding in the case of steam is that the higher pressures of steam are obtained at a very small additional expenditure of fuel. By means of compounding it is possible to take advantage of these high pressures, by expanding the steam in two or more cylinders, and so largely increasing the output of the engine at a very small extra cost.

In the case of steam hammers, therefore, there is a theoretical advantage in adopting compound cylinders, though there are practical difficulties, such as the weakening of the piston rod, etc., which limit its practical advantages. In cases of air, however, there is nothing to be gained by the adoption of such a system. Every increase of pressure in compressed air requires a proportionately extra expenditure of power to create it, and higher pressure involves greater leakage, and heavier losses from the dissipation of the heat of compression. The theoretical gain due to compounding in the case of steam has no parallel in the case of air, in which higher pressures require proportionately more power, and when applied to the design of hammers, involves a wanton complication of parts, and is a mere waste of power.

Choice of Pressure.

In air driving, the choice of a suitable pressure is of more importance than is generally realized. While it may sometimes be necessary to drive hammers by high pressure air, where a compressor plant is already installed for driving pneumatic hand tools, no advantage is gained by its use for forging hammers, and its use is always costly. The lowest pressure compatible with reasonable dimensions of cylinder and all-round convenience should be adopted. The best pressure to use is 45 lb. per sq. in., and a low rate of expansion may be used, say, 2 to 1.

In a steam engine the clearance losses are reduced by arranging that the piston shall approach very near to the cylinder cover at each end of its stroke, and that the passages between the valve and the cylinder shall be as short as possible. In the case of a hammer this can be done to some extent at the top of the cylinder, but at the bottom there is necessarily a very large clearance owing to the thickness of work being dealt with. There is, therefore, a very heavy clearance loss in such a case, if air is alternately admitted to and exhausted from the lower side of the piston. Also, since the hammer falls with very great velocity, which increases as it descends, a considerable "back pressure" is created in forcing the air out from the lower part of the cylinder through passages which must of necessity be small.

In the Massey patent compressed air hammer, both these sources of loss are eliminated, by arranging that the lower side of the piston shall be constantly submitted to an air pressure tending to lift the hammer; air being alternately admitted to and exhausted from the upper side only.

This allows of the air passage to the lower side, and the clearance at the bottom of the cylinder, being as large as is desirable, without entailing waste. The effective pressure on the down stroke is a differential one, due to the difference in area between the top side of the piston and the annulus round the piston rod on the bottom side. This difference is kept as great as possible by making the annulus just sufficiently large to allow an easy rise of the piston after the blow has been struck, and by making the rod or ram of very large diameter. A very important feature of this hammer is that it uses the air expansively. This action is absolutely automatic, and is attained without the use of any valve gear.

Pneumatic Power Hammers.

The criticisms that have been made with regard to hammers driven by compressed air, do not, however, apply to hammers in which the motive power is a shaft, or a direct coupled electric motor. There are types of power-driven hammers which are no more costly to run than steam hammers under average conditions, while in many cases, where power is cheap, they may cost very much less.

The fact that many of these hammers are known as pneumatic power hammers needs a word of explanation. Confusion has sometimes arisen between the "compressed air hammer" which is driven by compressed air from an external supply—in the same way as a steam hammer is driven by steam—and the "pneumatic power hammer" which is a belt or electric driven machine. The latter has its own pump which compresses the air and uses it as a medium, by which the unvarying and inelastic motion of the shaft and crank is transformed into an elastic blow, the length of which can be varied at will.

The pneumatic hammer has passed through various stages, and it is not the purpose of the writer to deal with forms which have been superseded. He will deal more especially with the types of hammer mostly produced at the present time. These will all be found to be similar in one respect—namely, in the possession of two cylinders, in one of which a pump piston reciprocates, while the other contains the hammer piston and rod. The systems differ, however, in the distribution and action of the air which forms the connecting link between the two moving parts.

Suction Lifter Pneumatic Hammers.

In some cases the hammer piston is raised by suction and thrown down by pressure, alternately formed above it by the reciprocating pump piston. The objections to such a system are, firstly, that the suction can only amount to a very few pounds per sq. in., since, even when the vacuum is greatest, there must still be enough air present to give the pressure for throwing down when the pump reverses; conversely, the pressure for throwing down can only be low, else the suction on the return stroke would be too feeble to lift at all. Again, there must be an interval between the time when effective lifting force ceases and effective depressing force begins, and vice versa.

It follows that in such hammers the lifting and depressing forces are necessarily small, and only act for part of the stroke, and, therefore, that the tup can only be light in proportion to the cylinder diameter—it is sometimes only a hollow casting—and that the action is feeble and slow. Clearly such hammers cannot be regarded as satisfactory substitutes for steam hammers, in which the tup is both lifted and thrown down by pressure.

The characteristics of the steam hammer blow can only be reproduced by a tool which employs the motive fluid in

the same way in which a steam hammer does. That is to say, in order to find a satisfactory power-driven substitute for the steam hammer, it is necessary to look for one in which both the rise and fall of the hammer piston are accomplished by pressure.

Method of Driving.

Pneumatic power hammers may be driven either by a belt from a line shaft, or by a direct coupled electric motor. The chief advantages of the direct electric drive are:

(1)—Hammers so arranged can be placed anywhere without reference to the position of engines, shafting, etc., and can thus often be used to greater advantage than when the choice of position is restricted to places where a belt-drive exists, or one could be conveniently installed.

(2)—The absence of belts enables cranes to be used over, and on all sides of the hammer.

(3)—There is no loss of power when the hammer is not working, as is the case when heavy shafting and belting is kept running continuously. In direct motor drives the motors can be stopped when the hammers are not in use.

(4)—A single hammer can be used when the rest of the machinery is standing, which is a great convenience in the case of a special job having to be pushed forward by overtime or night work.

(5)—Where special conditions require the speed to be varied from time to time, this can be accomplished electrically.

LOCATING LOSSES IN BELT TRANSMISSION.

By C. T. R.

THE factory superintendent who knows his business is constantly seeking new ways of overcoming loss of power in belt drives. Every belt in a factory drops some power which has been paid for but never received at the final point of application. This loss may run from a nominal amount up to fully half of the actual power delivered at the drive pulley. Efficient production demands that this loss be reduced to a minimum. How to do it is an important study.

Given pulleys of the correct diameter and width, and the proper speed for the machine in question, the greatest loss occurs through slipping or binding of the belt. Dry, hard belts running over slippery pulleys either waste a vast amount of power through slipping, or they have to be drawn so tight that they waste a correspondingly great amount of power through friction. Belts should be run loose and they should be kept in such a natural soft condition that they grip the pulley surfaces firmly without the use of sticky belt dressing.

There is another point where a great loss of efficiency occurs and this is at the joint or lacing, for unless the joint be smooth and flexible, it requires considerable extra power to drive it over the pulleys. A stiff joint works like a street car with a flat wheel, and a joint with an offset or bump on the pulley side may be compared to a wagon wheel passing over a stone on a smooth pavement. Both produce a jerk and both use up unnecessary power.

It has long been known that belts laced with leather lacing are open to the latter criticism, and, furthermore, leather lacings break oftener and take much longer to do than the modern steel lacings. A good steel lacing is superior to leather lacing in durability and saving of time, but the character of the steel lacing should be carefully investigated before a choice is made. The metal lacing must be strong and it must be as flexible as the belt itself. It should be quick and simple in application, proof against rust and corrosion, and the points of the metal which enter the end of the belt should be so made that they divide the strain evenly and do not cut off any of the belt fibres, for this weakens the belt.

Some metal belt lacings have been very severely condemned by safety authorities because the prongs work loose and catch the clothing or hands of the machine operators, yet this cannot occur where these prongs point back toward the end of the belt and are sunk in flush with the surface.

STAFF OF STEAM BOILER BRANCH, DEPT. PUBLIC WORKS, PROVINCE OF ONTARIO. READING FROM LEFT TO RIGHT:
D. M. Medcalf, Chief Inspector.
G. Guillet, Clerk and Bookkeeper. W. H. Bradt, Inspector. T. J. Main Inspector.
G. Drummond, Inspector. A. Brown, Inspector. W. Burns, Inspector.

MY FUTURE—A CREED.

By H. F. Frasse.

I KNOW that my future depends upon myself, because the manner in which I perform the duties assigned me will determine my value.

I shall always give a heaping measure, that my pay may be in proportion to the service I render.

It shall be my aim to work for, talk for, and boost my employer, because I am one of the organization.

Under no circumstances shall I listen to or take part in discussion affecting hurtfully the welfare of my employer.

I believe that every man will find if he look carefully into his own work that he has an undiscovered character for good; as well as that he possesses loyal service to give his employer.

I know there is no substitute for thorough-going, ardent and sincere earnestness, nor does it come of its own volition. It must be considered and made positive in each man's mind.

I am convinced that one man is better than another according to the quality, more than the quantity, of work he performs.

I shall always be cheerful with my associates and outsiders, because cheerfulness is contagious, lightens the work and brings credit to my concern.

Light hidden under a bushel is seen by no one, hence is of no value in making comparisons.

I shall let my light so shine that all men may see my good work and benefit thereby.—N.E.L.A. Bulletin.

WEDGES, SCREWS AND SCREW JACKS.

By H. Womersley.

THE wedge is a double inclined plane, hence when two bodies are forced asunder by its means in a direction parallel to its head, by multiplying the resistance by half the thickness of the head or wedge back, and dividing the product by the length of one of the inclined sides; the quotient is the force equal to the resistance.

Example.—The breadth of the back or head of the wedge being 3 in., and its inclined sides 10 in., required the power necessary to act upon the wedge to separate the substances whose resisting force is 150 lbs.

$$\frac{150\times1.5}{10} = 22.5 \text{ lbs.}$$

When only one of the bodies is moveable, the whole breadth of the wedge is taken as the multiplier, and the following rules are for such wedges acting under pressure on the head of the wedge only.

To find the tranverse resistance to the wedge or weight; multiply the power by the length of wedge, and divide by the breadth of the head.

To find the power: multiply the weight or tranverse resistance by the breadth of the head, and divide by the length of the wedge.

To find the length of wedge; multiply the weight by the breadth of the wedge, and divide by the power.

To find breadth of wedge: multiply the power by the length of the wedge and divide by the weight.

The Screw.

The screw in principle is that of an inclined plane wound around a cylinder which generates a spiral of uniform inclination; each revolution producing a rise equal to the pitch of screw. The pitch being the height or angle of inclination, and the circumference the length of plane, when a lever is not applied; but a lever being a necessary qualification of the screw, the circle which it describes is taken, instead of the screw circumference as the length of the plane; hence the mechanical advantage—as the circumference of the circle described by the lever where the power is applied is to the pitch of the screw, so is the force to the resistance.

Example I.—Required the effective power obtained by a screw ⅞ in. pitch, and moved by a force equal to 50 lbs. at the extremity of a lever 30 in. long.

$$\frac{30\times2\times3.1416\times50}{.875} = 10760 \text{ lbs.}$$

Example II.—Required the power necessary to overcome a resistance equal to 7,000 lbs. by a screw 1¼ in. pitch and moved by a lever 25 in. long.

$$\frac{7000\times1.25}{25\times2\times3.1416} = 55.73 \text{ lbs.}$$

The Screw Jack.

To find the weight a screw jack is capable of lifting, the screw being ½-in. pitch, radius of handle 30 in. and force applied 40 lbs.:

$$\frac{40\times30\times2\times3.1416}{.5} = 15,080 \text{ lbs.}$$

CANADA'S EXPORT TRADE.

DURING the month of December, according to figures issued by the Department of Customs, the exports of Canada underwent a remarkable increase. The exports of domestic produce during December, 1913, amounted to $55,803,642, as against $38,658,625 in December, 1912, the increase thus being $17,145,017, or 44 per cent. By far the largest item in the total was the export of agricultural products, which stood at $35,367,942, as against $22,859,325 in the corresponding month of 1912, the increase being a trifle over $12,500,000, or nearly 55 per cent.

Manufactures.

There also was a heavy proportionate increase in the export of manufactures, the figures being $5,599,086, as against $3,800,805, the increase being within a few dollars of $1,800,000, or more than 47 per cent. There was also a heavy increase in animals and their produce, the figures standing at $4,744,056, as against $2,791,550, the increase being $1,952,506, or nearly 70 per cent.

During the nine months' period ending December 31, 1913, the exports coming under the head of agriculture showed an increase of about 50 per cent. over those of the corresponding period of 1912. They stood at $177,706,169 in the latter, as against $119,209,170 in the earlier period, the increase being $58,-696,999.

Substantial Increase.

Animals and their produce also showed a substantial increase, from $36,740,883 to $43,568,859. There also was a ten-million-dollar increase in the exports of manufactures, from $31,160,289 in 1912 to $41,478,454 in 1913.

The products of the fisheries have shown a marked and consistent increase. For the nine months' period they rose from $12,180,323 to $16,080,950, while for the month of December the increase was still more marked, the exports being $2,524,487 in last December, as against $1,680,499 in the corresponding month of 1912. The imports for consumption in December were $45,004,552, as against $51,142,509 in December, 1912.

There was a heavy importation of coin and bullion during December amounting to $7,567,279, as against $607,551 in December, 1912.

BOILER EXPLOSION FROM METAL FATIGUE.

ACCORDING to Engineering News, a vertical water-tube boiler exploded in the generating station of the Richmond Light and Railway Co. at Livingston, United States, as a result of which six men were killed and four others injured. The boiler, which was one of a bank of three installed in 1901, was blown through the roof of the station. The other boilers in the bank were uninjured except for damage to the brickwork. The boiler had been washed out on the day of the accident and put into service ten minutes before the explosion took place. The failure occurred in the bottom head, and, according to our contemporary, was due to fatigue of the metal at the point where the head was flanged up to join the drum.

MOUNT ROYAL TUNNEL.

(Continued from page 108.)

trucks and hauled back about 300 feet from the face.

Estimated Quantities.

An idea of the magnitude of the undertaking may be gained from the following estimated quantities:

Tunnel.

Excavation, earth	20,000 cubic yards.
Rock	405,000 cubic yards.
Concrete	50,000 cubic yards.
Steel and iron	4,400,000 lbs.

Terminal Site—Exclusive of Buildings.

Excavation, earth	540,000 cubic yards.
Rock	95,000 cubic yards.
Concrete in retaining walls, slabs and platforms	100,000 cubic yards.
Reinforcing steel	3,500,000 lbs.
Structural steel	8,000,000 lbs.

Organization.

Mackenzie, Mann & Co., Ltd., are doing the work, and as they are also the principals in the Canadian Northern Railway, the organization covering both design and construction is as follows:

S. P. Brown, managing engineer for Mackenzie, Mann & Co., Ltd., and chief engineer of The Canadian Northern, Montreal Tunnel and Terminal Co., Ltd.

W. C. Lancaster, electrical and mechanical engineer;

H. D. Robinson, engineer of design;

H. T. Fisher, tunnel engineer;

Richard Byers, general superintendent Western Division;

Edward Duffy, general superintendent Eastern Division;

R. T. Gent, master electrician and mechanic;

J. C. K. Stuart, first assistant engineer.

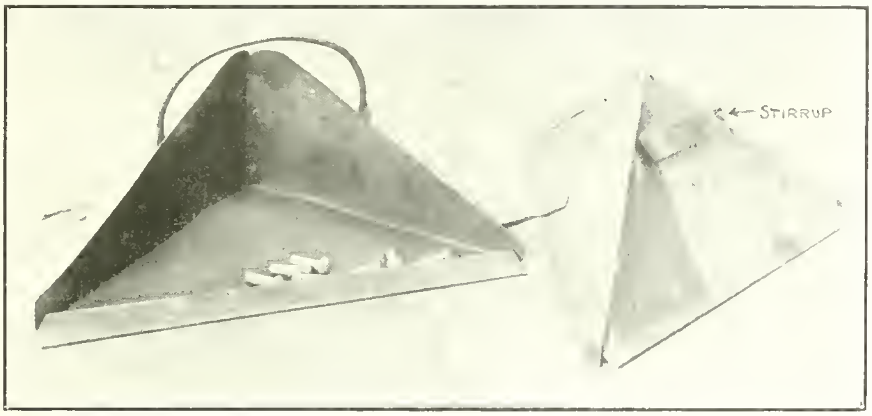
MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

A HANDY CATCH BOX FOR RIVETS.

By J. H. W.

THE catch box for rivets here illustrated is used in the new steel car shop of the Canadian Pacific Railway at Montreal. The stationary rivet furnaces are at present arranged along one side of the building, necessitating the throwing of the rivets some little distance in the case of cars being built on the opposite side of the shop. The box is placed in a convenient position near the work



HANDY CATCH BOX FOR RIVETS.

and in a line with the furnace; and rivet boys quickly become expert at throwing the rivets across the floor into the box.

The latter is formed from one plate, with a single vertical riveted joint at the back lap. A stirrup is attached to the bottom by four machine screws, and a light handle is provided for carrying the box around. The stirrup raises the box from the floor and thus prevents the heat of the rivets from damaging the latter, which in this shop is of a mastic composition. The stirrup of course gives the bottom of the box a slope towards the front, but the rivets are prevented from rolling out onto the floor by the flanged lip on the front edge. This lip has a triangular section for the sake of stiffness, and this form also serves to prevent rivets from jamming at the front. The illustration shows a front and back view.

SHOP HELPS.

By E. W. Tate.

THE following means of preventing work attached to the face plate from slipping, without undue tension being put on the holding down bolts, have been tried and their success proven:—

(1)—Packing tissue paper between work and face plate.

(2)—Applying evenly a coating of oil and fine emery between work and face plate.

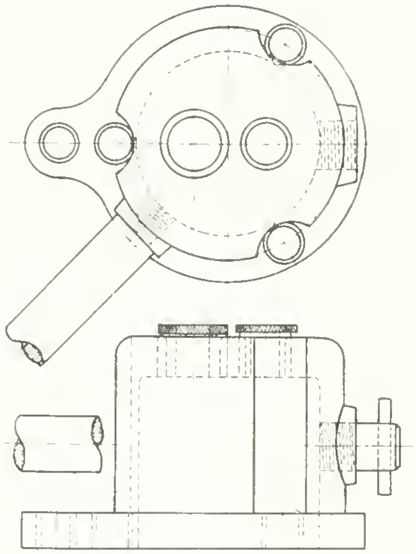
(3)—Applying a thin coating of hot shellac to the side of the work which will be placed next to the face plate, and also to the face plate after it has been removed from the lathe. The work should be quickly put on the face plate, then moved around so as to evenly distribute the shellac. A weight should next be placed on it, and allowed to remain until the shellac sets. For thin work, and of not too large diameter, clamp bolts will not be required.

JIG AND FIXTURE FOR IGNITER BODY.

By D. O. Barrett.

THE igniter body shown in the cut is used on several sizes of a line of gasoline engines. The casting is finished all over and the pressure maintained in the cylinder by the bevelled ground joint near the inner end. The 7-16 in. hole is merely drilled for a 5-16 in. stationary electrode, being countersunk at the ends for a number of 11-16 in. mica washers, which are used for insulation. The ⅜ in. hole is reamed for the movable electrode.

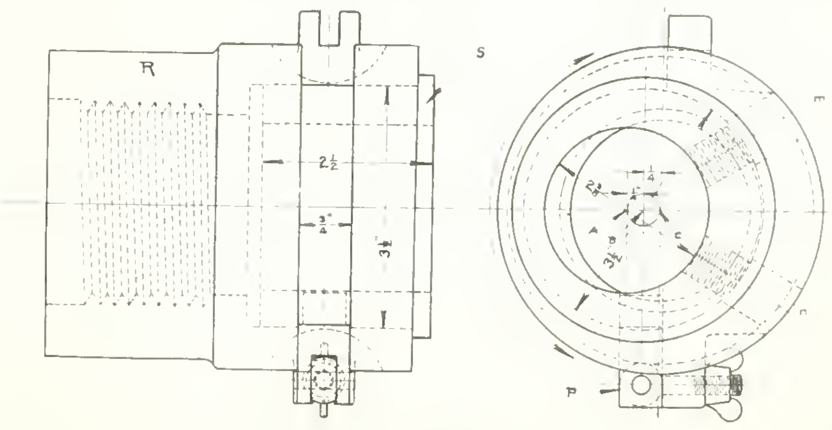
The rough casting is grasped by the flange in a 3-jaw universal chuck, being pushed against shoulders so that no



DRILL JIG.

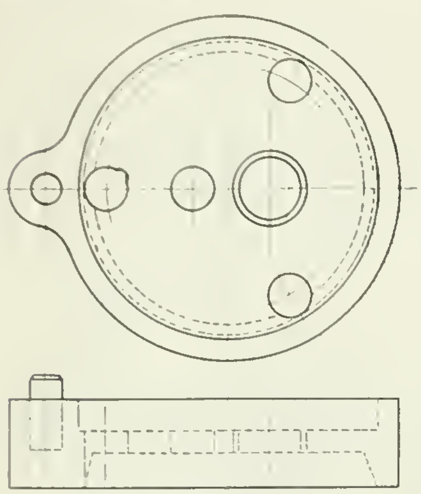
trueing up is necessary. The body of the casting and the inner face of the flange are then turned, after which there remains the turning of the post and the flange and the facing of the outer end. It will be noticed that the post is ½ in. off centre.

The casting is next slipped in the turning fixture and held by the headless set screws (m) and (n). The body (R) of the fixture is screwed on the lathe spindle. This is bored out to 3½ in. to



TURNING FIXTURE.

accommodate the sleeve (S), the hole being one-fourth inch off centre, or one-half the distance of the igniter post off centre. The sleeve (S) is inserted in the body (R) and carries a 5/8 in. x 3/4 in. steel post at one side, which is pressed in after the sleeve is in position. This post is slotted for the clamping screw,



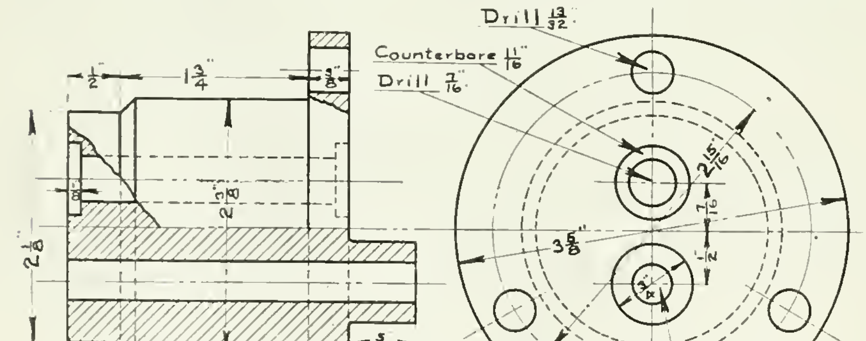
DRILL JIG BASE.

which is provided with a wing nut. A slot is milled across the main casting (R) so that the sleeve (S) can be turned through one-half revolution, the steel post (P) being brought against the casting and serving for indexing purposes. The lug on each side is milled through for the clamping screw.

The post (P) is turned to the upper side, and the sleeve bored out 2⅜ in. to hold the igniter body. This hole is now 1/4 in. off the centre of the sleeve, but is at the centre of the lathe spindle when the post is at the top, and is ½ in. off the centre of the spindle when the post is at the bottom, as shown in the drawing. The centre of the lathe spindle is indicated at (C); (B) is the centre of the sleeve (S); and (A) is the centre of the 2⅜ in. hole for the igniter body. In the position shown, the igniter body is inserted and the post brought as near the centre as possible by lining up roughly with the tail centre which is run up. Considerable stock is left on this post, as in casting quite a lot of difficulty was experienced with shrinkage troubles.

After being turned to size, the piece is laid in the drill jig base, the post dropping through the hardened bushing in same. The drill jig is then set down over the casting, the ⅜ in. pin in the base entering the bushing in the bottom of the jig. This automatically puts the jig in the proper relation both to the base and to the piece to be drilled. The screw at the side of the jig is then tightened. This jig is handled by the cold rolled steel handle projecting from the side.

The jig is held by the handle while all the holes are being drilled, reamed and counterbored. After all the operations are finished with the jig in position shown, it is lifted off the base and inverted, to allow the counterboring on the outer end being done, this finishing the piece. Loose bushings are provided for the ⅜ in. and 7-16 in. drills. These pieces were handled in remarkably quick time, as there was no clamping to be done, all locating being accomplished automatically.



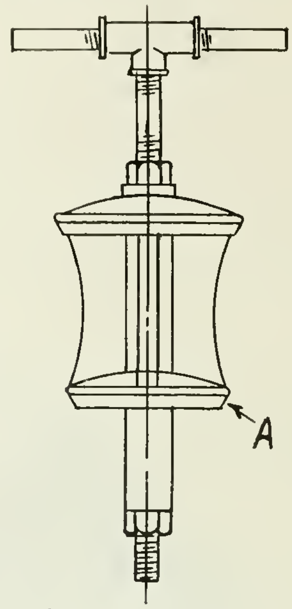
IGNITER BODY.

GRINDING EQUILIBRIUM VALVES.

By R. Bell.

VALVES of the equilibrium type, as used for locomotive throttle valves, also for bye-pass valves on locomotive steam chests, and for many other purposes, require great care to be exercised when being ground in. Unless this is done the valve will almost invariably leak at the smaller face (A). The general procedure is to grind the valve in by the usual method, using emery and oil on the faces and revolving by hand or other means until an apparently good bearing is obtained on both faces. The main difficulty seems to be the ability to determine when these are both O.K. The best means of finding out is to grind until no movement can be felt in either end of the valve when it is placed in its seat and the handle by which it has been ground shaken gently. Before doing so, all emery must be removed from both faces.

I find after grinding in the usual way, and then applying this test, the valve



GRINDING EQUILIBRIUM VALVES.

will almost always be found to shake a little at the small end. There being less area there, it seems to grind away a little more. The usual test of cleaning off the grinding material and revolving the clean faces together to show up the bearing is unsatisfactory, as the bearing will show good on the small face, due to the bottom end of the valve wobbling, and thus picking up a bearing. When one end is found to move, the remedy is to grind the opposite end, and very little will be found sufficient, as a very small movement can easily be detected. The sketch shows a locomotive throttle valve, with a suitable handle for grinding, made of pipe fittings in position.

THE FAULT ON BOTH SIDES.

By N. G. Near.

"ALWAYS follow the blue prints, John, and don't take anybody's word for anything. For making this bull we'll have to dock you three dollars this week, because it was an expensive mistake. I hate to do it, but them's the orders, and it's for the good of you and the Company. Let this be a lesson to you. I made the same error once myself, and they soaked me for it, too." Thus spake the foreman to a machinist who had disregarded the blue print dimension for the inside shell diameter of a fan casing. The foreman had previously talked to the machinist about a change in design, and had told him that the diameter of the fan was going to be changed, and that the bore of the casing

at the position of the fan would be changed from 26 in. to 28 inches. John had misunderstood the foreman. He thought the foreman wanted the casing he was working on bored to 28 in., so he went ahead and cut it to that size without asking any questions, in spite of the fact that the blue print before him specified 26 inches very distinctly. Hence the "call."

Of course the casing wasn't ruined. It was repaired by casting a ring, turning down, and press-fitting it into place. Doubtless the Company who purchased the fan never noticed the patch.

John, however, was sore. He knew very well that the three dollars he was docked was not enough to cover the loss to his employers, still he was peeved and was lying low for an opportunity to get even with the foreman. So one day, while John was boring out a 12-in. cylinder, in which a packing ring was shown and dimensioned in the blue print, the foreman came around and told John that the superintendent had told him (the foreman) that a special cylinder was wanted, with the packing ring omitted. Therefore, the packing groove should be omitted out of this cylinder.

John listened patiently and said nothing. He now saw his opportunity to get even—just what he had been looking for—and the groove was turned in the cylinder as per blue print.

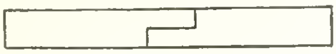


FIG. 1

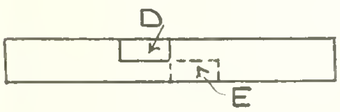


FIG. 4

SPLITTING GAS ENGINE PISTON RINGS.

When the foreman discovered the "error" he was furious. He called John names that could never be printed, and thereat John unloaded a few of his own thoughts that he had been storing in his mind since the time he was docked three dollars. "A couple of weeks ago," he said, "you told me to always follow blue prints and not to take anybody's word for anything. That's exactly what I have done, and now you say I'm wrong again. How the devil am I to know what is right?"

Being up against the type of foreman who would reason with no man when angry, John was discharged on the spot. He did not leave, however, until he had filled the shop with a pretty choice selection of cuss words.

It is clear that both were wrong. In the first place, the foreman should not have said, "Don't take anybody's word for anything." He should have given the man credit for having a little common sense. No man likes to be a machine. Any ambitious man craves responsibility. In the second place, John should not have turned the groove in the cylinder. The reason why it was not wanted was perfectly clear to him. He had turned the groove out of sheer stubborness, knowing all the while that he would be reprimanded for it.

It is impractical to run everything systematically; therefore, we should be careful in making rules, and instead of reprimanding a man severely, rather advise and reason with him, and give him credit for being a human being and show him that you are his friend.

METHOD OF SPLITTING GAS ENGINE PISTON RINGS.

By R. Bell.

IN a works manufacturing small power gasoline engines, workshop methods were of a very primitive nature; a case in point being the splitting of piston rings. These were split, as shown in Fig. 1, and were cut by means of a hacksaw,

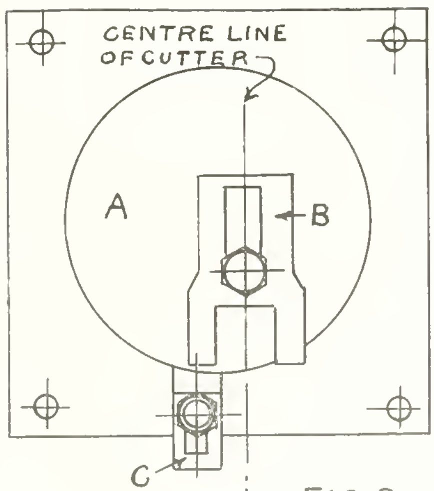


FIG. 2

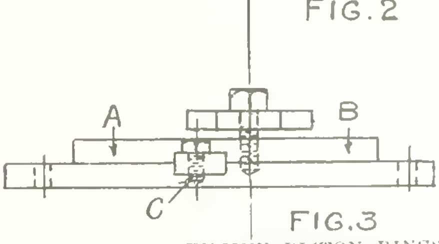


FIG. 3

SPLITTING GAS ENGINE PISTON RINGS.

½ in. being cut out to give the rings the desired amount of spring. The operation of cutting a ring and fitting it into the mandrel jig took about fifteen minutes.

The following method was introduced by which seven rings could be cut ready for use in fifteen minutes. A jig, as shown in Figs. 2 and 3, was made to fix on the milling machine table. The centre part (A) was made to allow the rings to slip on easily. When in position, the ring was held by the clamp (B), the point of which was split to allow a ½-in. milling cutter to pass into it. The spindle of the machine was adjusted for height, so that when a cut was run through a ring, it took exactly half the ring, as shown at (D) Fig. 4. A big number of rings were cut on one side.

The second operation of cutting the other side was next performed. To do this accurately and quickly, a feather (C), Fig. 2, was provided, the edge of the cutter just coinciding with the edge of this feather. During the first operation this feather was kept back, but on starting the second, it was moved forward against the edge of the centre part (A). The cut part (D) of the rings was placed over this feather, and a cut taken through the other side, as shown by the dotted lines at (E), Fig. 4.

With accurate adjustments this just split the rings, and left them ready to put on the mandrel for turning to cylinder diameter. The result was a big saving in time as well as in saw blades.

CONCERNING BELT SPEEDS.

By W. E. Mason.

I WISH to secure such information as will allow me to solve some belt speed problems. We had a chain drive enclosed in a case and the chain ran in oil. The pulley diameters were 15 in. and 4½ in. respectively, but we could not get the speed required, namely 2,000 r.p.m.

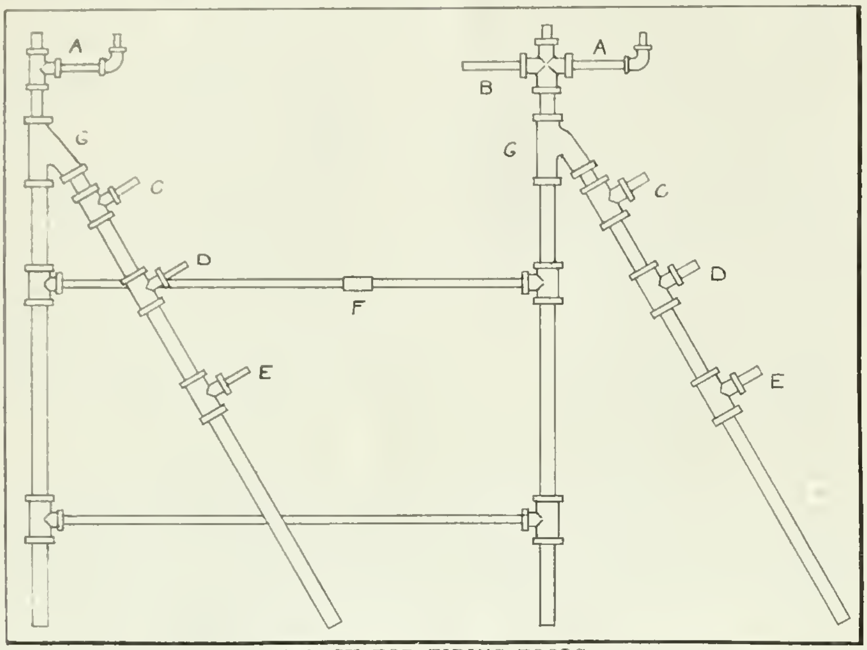
The chain drive made more noise than anyone could believe, and after three weeks running, the chain snapped and the case was damaged beyond repair, one of the parts of the chain embedding itself 1½ inches in a brick wall, 30 ft. from the pulleys. We did away with the chain drive after that experience and installed belting with larger pulleys. The engine room is comparatively quiet now, although there is still room for improvement. I want to know the speed of the belt in feet per minute, and to get the rule for ascertaining belt speeds. Do you think the speed is too fast? If so, what will be the remedy. The belt is double cut square, laced, and 8 in. wide.

To intelligently answer the foregoing, the diameter of the belt pulleys should be given.—Ed.

PIPE RACK FOR FIRING TOOLS.

By J. E. N.

THERE have been some curious and wonderful arrangements made and used from old pipe fittings and scrap pipe. Here is another one, and which I am told is new. It is made from one inch pipe screwed tightly into the fittings shown, and is used to hold the rake, hoe and other firing tools on the spikes (C) (D) and (E). If the fireman is the lucky owner of an extra slice bar or other tool, he can place it ready for business in case one of his regular kit gets broken, on the arms shown at (A), and if he has an extra shovel he can hang it on bar (B). The coupling at (F) is right and left hand. If required the half Y fittings (G) can be replaced with full Y's, in which case the rack would probably be harder to upset, but it would occupy much more space then if built as shown.



PIPE RACK FOR FIRING TOOLS.

GRINDING LOCOMOTIVE LINKS.

By A. E. Granville.

A GRINDER used in the Illinois Central Railroad shops, Vicksburg, Miss., for grinding locomotive links, is illustrated in Figs. 1 and 2. The link to be ground is held in the forks of two long swinging arms by means of set screws as shown. The arms are slotted so as to be adjusted for length, in order to obtain the proper radius. The pin on which these arms swing is carried in a block which slides in the pipe suspended from the ceiling. The block is run up or down by means of a screw inside of the pipe, and operated by a small handwheel on the lower end. This constitutes the feed, and is worked as the operator swings the link back and forth over the grinding wheel. As the wheel and spindle are slender, a support is provided at the outer end. This is more clearly indicated in the second cut.

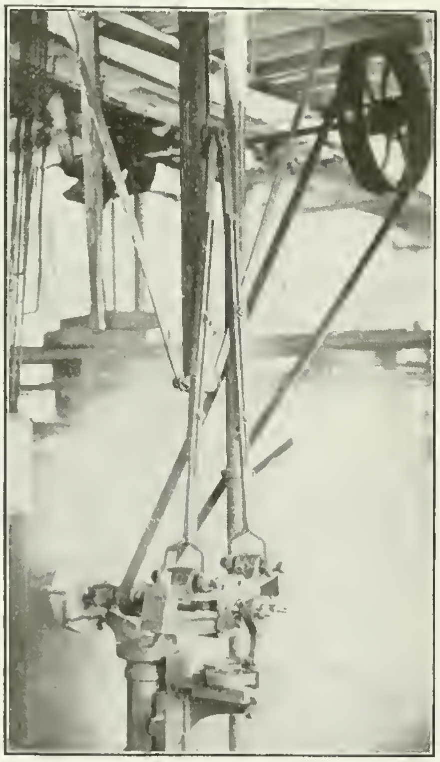


FIG. 1—GRINDING LOCOMOTIVE LINKS.

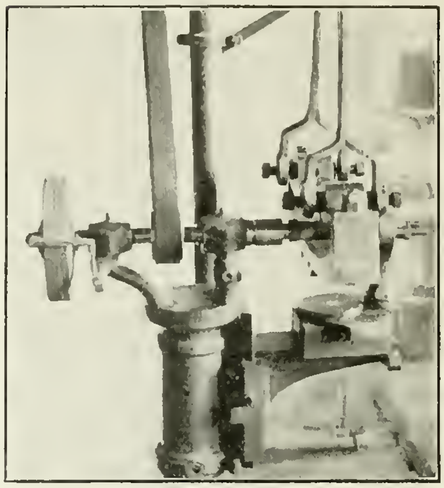


FIG. 2. CLOSER VIEW OF GRINDER.

NEGLECTED SAFETY PRECAUTIONS.

A TIMELY article in the "G. W. R. Magazine" calls attention to some obvious safety precautions, which, however, are too often neglected by machinists and others. Says the writer:

"You can't afford to be careless with moving machinery. Some men have a knack of trifling with lathes and machines for drilling, planing, shaping, and the like. They scrape the chippings away with their hands. They're given a little brush for the job, but it is too much trouble to use it. Injuries to fingers are quite frequent through this. The "safety" plan pays. It takes less time to pick up a brush than to get rid of a damaged finger." "Safety first," is a promising resolution for the new year.

COMMERCIAL SITUATION REVIEW.

SIR GEORGE PAISH, reviewing the financial and commercial situation in the Statist this week, predicts a long period of cheap money—unforeseen happenings apart—which will become more abundant and cheaper as the year advances. He recognizes that trade is falling, but says that the decline is less in Great Britain than in European countries, which are suffering from the influence of the Balkan war.

Sir George thinks that there are grounds for hoping that British manufacturers will be well employed for some time to come. France, he says, will benefit from the loans which she is about to issue, and which are likely to bring her numerous new orders. As a result she will suffer less than other countries from declining trade. The same may be said to a certain extent of Germany.

Recovery in the U. S.

"In the United States," says Sir George, "we expect a recovery rather than a decline, for the reduction of the tariff and the new Banking and Currency Act are calculated to benefit trade when the few difficulties of the reduction of the tariff are overcome. American manufacturers will be able to compete with foreigners much better than formerly, while the new banking law ought to give a great stimulus to foreign trade in every direction. We anticipate therefore comparative steadiness of trade in the United States, assuming that the crops will be good."

Series of Practical Questions and Answers for Engineers

Every care is being taken to include only pertinent practical questions, and give same, direct reliable answers. Catch questions will be avoided. Arithmetic, consisting of simple addition, subtraction, multiplication and division of decimals, will be found a most useful companion study, and should not be overlooked.

Question.—To what strain is the shell of a steam boiler subject?

Answer.—To a tensile or tearing apart strain in the girth direction of the plate. For this reason we use the ultimate tensile strength of the material, in calculating the working pressure permissible.

* * *

Question.—If you were specifying the steel for boiler shell plates, what qualification would you make in respect to thickness and quality?

Answer.—That each be uniform, providing equal wear and strength throughout.

* * *

Question.—Is the shell of a boiler equally strong longitudinally and circumferentially?

Answer.—No, it is twice as strong in the latter direction as it is in the former.

* * *

Question.—In a new, well-designed, well-constructed boiler, where is the shell weakest?

Answer.—Along the riveted joint, due to the rivet holes.

* * *

Question.—Why is a butt joint preferable to a lap joint in a steam boiler?

Answer.—Because it avoids offsetting the plate ends, keeps the shell in a true circle, and gives a stronger joint.

* * *

Question.—What is the objection to welding the longitudinal joints of a boiler shell?

Answer.—No guarantee can be had of the reliability of a weld. The pressure being internal and bursting, would tend to aggravate any imperfection, and open the weld, causing an explosion.

* * *

Question.—What is the difference between a tube and a pipe?

Answer.—A tube is indicative of surface, a pipe of area. Example—A 3-inch tube will measure 3-inch outside diameter, while a 3-inch pipe will measure 3-inch inside diameter.

* * *

Question.—Are two 4-inch pipes equal in area to one 8-inch pipe?

Answer.—No. The 8-inch has an area double that of two 4-inch pipes. Doubling the diameter, therefore, increases the area fourfold.

* * *

Question.—A water tube boiler has 150 tubes $3\frac{1}{4}$ inches outside diameter by 15 feet long. What is the heating surface in the tubes.

Answer.—First calculate the circumference of a tube $3\frac{1}{4}$ inches outside diameter and divide the result by 12 in order to get the answer in feet. Multiply this result by 15 feet length, and we shall get the heating surface of one tube expressed in square feet. The total heating surface of the tubes will be 150 times this amount.

$$\text{Thus } \frac{3.1416\times3.25\times15\times150}{12} = 1914.41$$

* * *

Question.—In a certain machine the work that should be obtained theoretically is 800 foot-pounds in a given time. The amount actually obtained, however, is found to be only 576 foot-pounds. What is the efficiency of the machine?

Answer.—Divide the actual amount of work by the theoretical. Express the result as a decimal fraction. The quotient represents the efficiency of the machine. Thus $\frac{576}{800} = .72$, therefore, the efficiency of the machine is $\frac{72}{100}$, or 72 per cent.

* * *

Question.—A safety valve is 3 inches in diameter; the lever is 24 inches long and weighs 15 pounds, its centre of gravity being 13 inches from the fulcrum. The weight of the valve and valve stem is 12 pounds, and the centre line of the valve is 4 inches from the fulcrum. If a weight of 70 pounds is hung on the end of the lever, at what pressure per square inch will the valve commence to blow off?

Answer.—First calculate the area of the valve, thus $.7854\times3\times3=7.068$ sq. in. The forces holding the valve down on its seat are three in number:

(1)—The weight, 70 lbs., multiplied by its 24 inches distance from the fulcrum.

(2)—The weight of the lever, 15 lbs., multiplied by the 13 ins. distance of its centre of gravity from the fulcrum.

(3)—The weight of valve and stem, 12 lbs., multiplied by their distance, 4 ins., from the fulcrum.

The above three moments act downwards, and their sum must be equal to the upward moment due to the total pressure on the valve, multiplied by its distance, 4 ins., from the fulcrum.

Call the boiler pressure P pounds per square inch. Then

$$P\times7.068\times4=(70\times24)+(15\times13)+(12\times4)=P\times28.272=1680\times195\times48=1923$$

$$P=\frac{1923}{28.272}=68 \text{ pounds.}$$

* * *

Question.—What is understood by the term "ultimate strength" when referring to materials of construction?

Answer.—It is the load which applied under the most favorable conditions, gradually without shock, vibration and intermissions or repetitions of stress will cause rupture or some other form of destruction; also, without regard to the elastic limit, and without regard to the final load wihch would complete rupture after breaking down of the material had commenced. In contradistinction to this, it may be stated that the actual capacity of a material to resist rupture depends on the nature of the load, and only whether applied suddenly, in which case, assuming the substance to be perfectly elastic; the member would give way simply from the apparent load being thereby doubled, but also upon the number of repetitions and the amount of the variations of stress. The experiments of Wöhler show that the greater the variation in the stress, the less the capacity for resistance on continual repetitions. This is most markedly so when the alternate stresses are in opposite directions, as is the case when a member is subject to tension and then compression. This is the condition in the piston rod of an engine which gets steam on both sides of the piston. The rod of a single acting air pump may be cited as an example of alternation between stress in one direction and the passive state, the conditions here not being so secure, and consequently the capacity of resistance greater on the continual repetition of the load.

Replacing Gauge Glasses.—One of our subscribers in Guelph, Ont., has experienced trouble through gauge glasses breaking within a few hours of their replacement after removal and cleaning. He says no such trouble arises when putting in new glasses, and believes, therefore, that an explanation of the breakage on replacement is possible, which, if put to practical use would eliminate the latter. Will some of our readers give their experiences in this feature of boiler room engineering?

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

ADJUSTABLE PROTECTION HOOD FOR GRINDER.

THE Valley City Machine Works, Grand Rapids, Mich., have added to their well-known line of grinders the adjustable protection hood here illustrated. The hood is applicable to any make of emery wheel stand, and affords protection to the smallest diameter wheels that it is practicable to use. It also protects the nut on the arbor.

ADJUSTABLE PROTECTION HOOD FOR GRINDER.

The photograph shows the 24 in. hood adjusted down to fit over an 18 in. diameter wheel. The latter, it will be noted, is fully protected, and the hood adjustment backward is such that the face of the wheel is get-at-able. The guards are made in all sizes from 8 in. to 24 in. diameter.

ROTARY SURFACE GRINDING MACHINE.

THE text and illustration refer to a new high duty surface grinding machine placed on the market by the Heald Machine Co., Worcester, Mass. It has been designed especially for the rapid and accurate finishing of flat surfaces on parts in great variety, such as can be rotated within a diameter of sixteen inches. Incorporated in its design are a number of excellent features that make it exceptionally convenient to handle, and insure a maximum output by eliminating the element of wasted time.

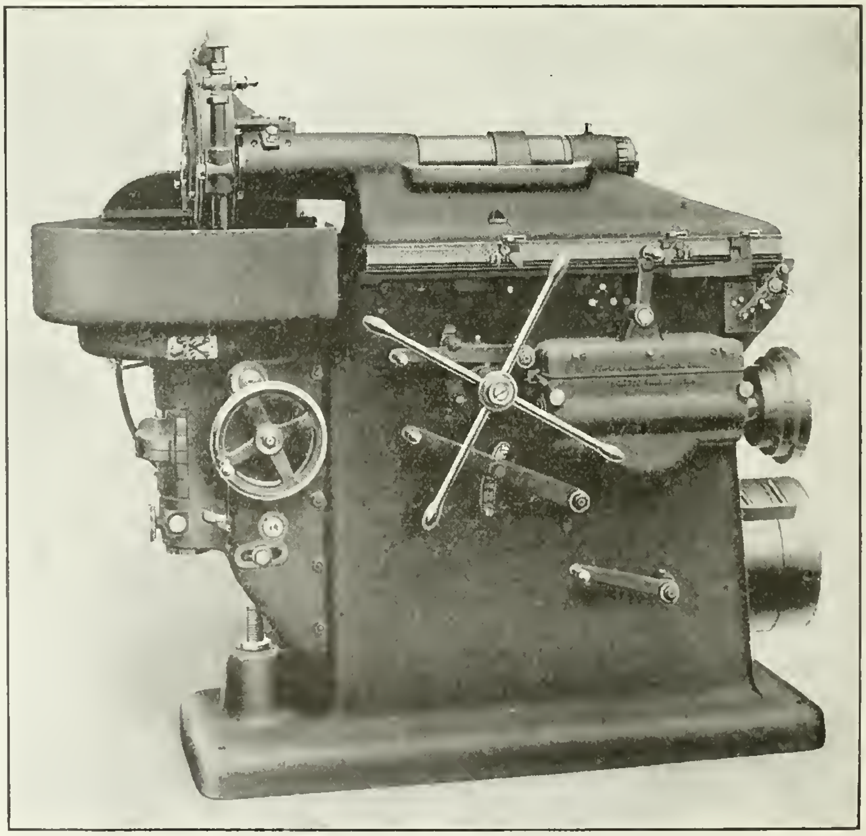
The machine is massive in construction, with the metal so distributed that the greatest rigidity is obtained, contributing to extremely accurate work, highly-finished surfaces and large production. No counter-shaft is required, as the machine is self-contained, receiving its power from a single belt direct to the main line shaft. All bearings have generous diameters, all shafts are carefully ground to accurate dimensions, and the ways, which are liberally supplied with oil, are provided with broad wearing surfaces that ensure the maintaining of proper alignment.

The grinding is done by the periphery of the wheel. Feed lines and radial scratches are eliminated by using the wheel in this way. The wheel spindle is large in diameter, hardened and ground, runs in adjustable phosphor bronze bearings provided with suitable means of lubrication, and with efficient adjustment for wear. The belt pull is downward, which, added to the weight of the wheel slide, prevents the wheel from lifting under heavy cuts.

A 12-in. or 16-in. magnetic chuck for holding the work is regularly furnished as standard equipment, but if the work to be ground can be held in chucks of other types, or by special fixtures, they can be substituted readily. Angular adjustment to the chuck or work spindle is provided for grinding concave or convex surfaces, a feature also valuable for correcting any disalignment that may take place. The work is fed to the wheel by elevating the chuck. This is accomplished by means of a screw and hand wheel having a graduated dial reading in thousandths of an inch. Automatic vertical feed to the chuck can be furnished when specified, and is a valuable feature when more than one machine is to be run by one operator.

The machine is regularly equipped with pump, tank, water guards and all connections for wet grinding. A generous supply of water under absolute control of the operator is delivered at the grinding point, and the guards are so designed as to thoroughly protect the operator, keep the water off the floor and out of the bearings.

Centralized control is a strong feature of this machine, every lever and wheel being within easy reach of the operator from the position he naturally assumes when handling the work. While the actual diameter that can be ground is 16 in., the machine will swing 22 in., thereby making it possible to handle parts that have projecting surfaces, or feet,



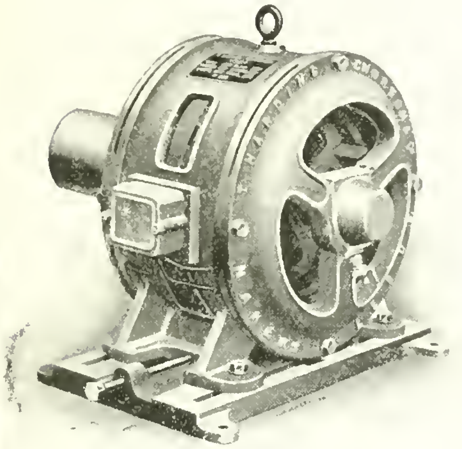
"HEALD" ROTARY SURFACE GRINDER.

beyond the actual diameter that can be ground. The thickness of work that can be handled is 4½ in. with full diameter of wheel; but work up to 7 in. can be handled by using a smaller wheel.

The floor space occupied is 4 ft. by 6 ft.; the power required 5 h.p., and the net weight 3,500 pounds.

THE "CHURTON" INDUCTION MOTOR.

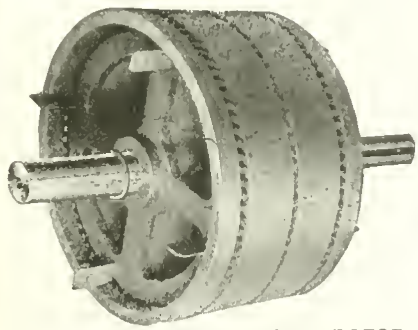
THE accompanying illustrations show a high grade induction motor as manufactured by the T. Harding Churton Co., of Leeds, England, who are specialists in producing alternating cur-



"CHURTON" MOTOR

rent motors. By giving unremitting attention to this particular line, they claim to have reached as near the acme of perfection as possible.

Noteworthy among the details of construction of Churton motors may be mentioned the connecting rings of the short current rotor. The usual methods of connecting these rings to the rotor conductors by bolts and nuts, or by riveting, are not infrequently causes of trouble due to the effects of continual



"CHURTON" SHORT CIRCUIT ROTOR.

expansion and contraction, and the efficiency of a motor with the rotor so constructed may seriously depreciate after working for some time. Another method of connecting the conductors by wires interlaced around the ends and soldered together has the disadvantage that the solder is apt to be melted off by temporary heavy overloads that the motor should sustain without injury. To overcome these difficulties the Churton people introduced their "cast welded" system, in which the connecting rings are, by a special process, welded direct to the conductors, thus obviating joints of any kind. This method has proven entirely successful, the rotors so constructed being practically indestructible.

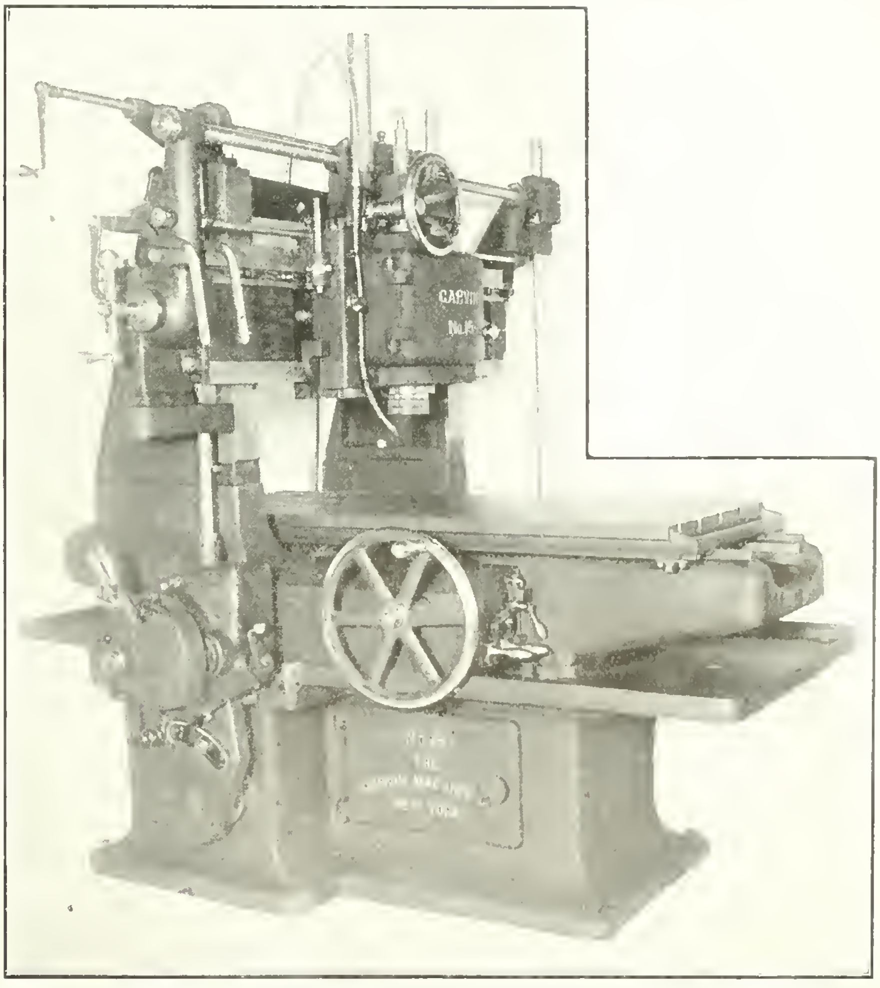
The Stuart Machinery Co., Ltd., of Winnipeg, Man., are the Western Agents for "Churton" motors, and carry a stock of sizes ranging from 1 to 50 h.p.

NO. 15 VERTICAL SPINDLE MILLING MACHINE.

THIS type machine, which has been developed to a high pitch of efficiency, by the Garvin Machine Co., New York, now offers a number of special features not formerly available. Both table and cross slide are provided with accelerated feed in either direction, controlled by automatic trips in the same manner as the regular feeds, thus saving time and conserving the energy of the operator. The drive is self-contained, being by cone pulley carried by bracket on the base of machine, and connected by splined shafts to the spindle. This greatly facilitates the application of motor drive, which can now be attached by silent chain to the cone pulley shaft as shown.

The power is applied through bevel and spur gears to the prolongation of the upper ends of the spindle and back shaft. By the shifting of one gear, the spindle may be driven direct at high speed, or through the back gearing at slow speeds, and in each case the direction of rotation is the same. The spindle has a threaded nose, ¾ in. diameter, 3½ pitch, left-hand, to take a B. & S. No. 24 cutter, and having power sufficient for a 12 in diameter, of cutter.

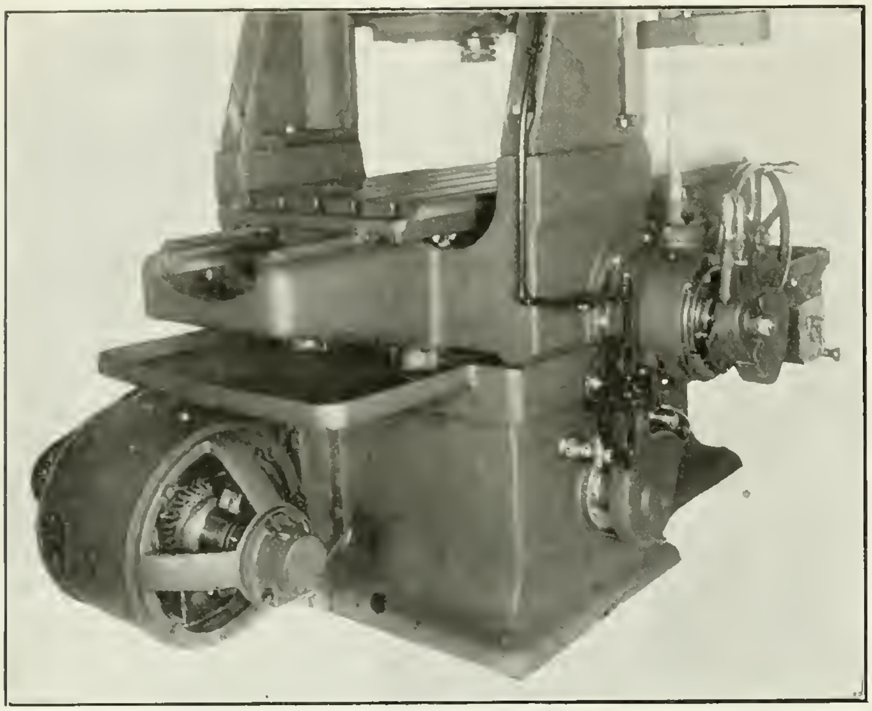
The table movement is by Seller's motion of oblique worm, ball thrusted, and controlled by pilot wheel. Both table and cross slide are fitted with double feed boxes, giving the regular and a very fast feed at will. Each kind of feed is thrown in by separate handle, and controlled by dogs on the table and cross rail in the ordinary way. Two kinds of dogs are provided on both table and cross slide. One set of dogs permit of tripping in either direction and coming up against a solid stop, and the others are buttons which trip, but permit of passing over. On the cross slide rail the same handle thrown in trips the feed. The fast and regular feeds are in the same rotation, so that the arrange-



"GARVIN" VERTICAL SPINDLE MILLING MACHINE.

ment permits of quick jumps over intervening spaces between cuts.

An interlocking arrangement prevents both kinds of feed being thrown in at the same time. One turn of the change feed handle throws the change box neutral, or out of action, and, when this is done, a special lever on the change box can be operated to traverse the table or cross slide rapidly back or forth by power. This special lever is interlocked with the change box to prevent accident.



"GARVIN" VERTICAL SPINDLE MILLING MACHINE.

An enumeration of the features of the machine includes the following:—Changes of back gears; vertical adjustment of spindle slide, with micrometer stops and binder handles; change feed box, with reverse of feed; convenient control of all movements; guarding and oiling of all gears; oil pump facilities.

CAN. CEMENT CO. CLOSING ONTARIO PLANTS.

THE following official statement was handed out this morning from the office of the Canada Cement Co.:

"Owing to dullness of business, we have decided to close down for the balance of the year 1914 or until further advised, plants No. 6, Marlbank, Ont.; No. 7, Lakefield, Ont.; No. 9, Shallow Lake, Ont.; and No. 10, Calgary, Alberta. W. H. Ford, general sales manager of the Company, stated that the disconraging prospects and the present stagnation in the building trade made this step imperative. Several cement companies have already gone under the the present stress, said Mr. Ford, and it was impossible for Canada Cement Co. longer to keep in operation mills which were running at a loss. No further shipments of empty bags will be taken at the Ontario mills after February 1.

FIRST STEAM VESSEL THROUGH PANAMA CANAL.

THE first passage of a self-propelling vessel through the Panama Canal from ocean to ocean was effected on the morning of Wednesday, January 7, when the crane boat Alex. LaValley, Captain Carter, formerly engaged in the Atlantic entrance, but recently operating in Culebra Cut, was passed from the Cut through Pedro Miguel and Miraflores locks to the Pacific entrance. Barges from the Pacific side, passed about in the dredging operations, had previously been handled to the Atlantic side. The La Valley left Pedro Miguel Lock at 9.30 a.m., reaching Miraflores locks at 10.15, and was passed into the Pacific channel at 11.05 a.m. No passengers were carried, only the regular crew being allowed on the vessel.

The La Valley is a unit of the old French floating equipment, and was built by Lobnitz & Company of Renfrew, Scotland, in 1887, afterwards being rebuilt at the Cristobal dry dock shops in 1905. She is an iron hull, twin screw vessel, with a length of 186 feet, beam 41 feet, and depth of 15 feet, equipped with forward and amidship cranes, the forward crane having a lift of five tons, and the amidship crane a lift of 56 tons. The propelling engines were built by Lobnitz & Company and are compound, the cylinders being 16 and 30 inches diameter by 24-inch stroke. The boiler is of the Scotch type, American make, length 12 ft. and diameter 12 feet.

OFFICIAL TRADE FIGURES.

THE following are the official figures of the trade between Great Britain and Canada, in the undermentioned articles, during December, 1913:—

From Canada—	Dec., 1913.	Dec., 1912.
Wheat	£911,469	£760,726
Wheat, meal and flour	196,171	196,122
Oats	34,525	20,749
Cattle	....	....
Bacon	52,031	69,929
Hams	23,083	19,501
Cheese	236,875	262,099
Canned salmon	149,731	66,808
To Canada—		
Spirits	52,970	46,136
Sugar	578	5
Wool	14,348	11,720
Pig iron	2,085	3,495
Railway iron	1,403	1,215
Galvanized sheets	8,564	21,873
Tinned plates	6,244	11,298
Steel bars, etc.	11,698	14,333
Pig lead	4,580	4,191
Unwrought tin	12,067	19,052
Cutlery	5,247	9,320
Hardware	6,030	7,467

The following table gives figures for the twelve months ended December 31, 1913:—

From Canada—	1913.	1912.
Wheat	£8,803,949	£8,844,953
Wheat, meal and flour	2,261,783	2,216,077
Oats	750,693	703,982
Cattle	36,212	142,508
Bacon	863,139	1,175,527
Hams	336,695	231,379
Cheese	4,038,627	4,347,832
Canned salmon	900,068	723,698
To Canada—		
Spirits	730,142	727,596
Sugar	40,803	122,192
Wool	119,434	128,316
Pig iron	189,442	265,957
Railway iron	6,329	17,535
Galvanized sheets	470,324	368,508
Tinned plates	155,444	123,266
Steel bars, etc.	341,066	195,886
Pig lead	141,644	213,354
Unwrought tin	175,549	196,638
Cutlery	106,706	119,880
Hardware	111,836	117,165

ACCIDENTS ON RAILWAYS.

THE Dominion Railway Commission report for the fiscal year ending March 31 last, states that 643 persons were killed on the railways, of whom 250 were trespassers, 21 passengers—of whom 15 met death in trying to leave or board trains while in motion—and 303 were employees. The injured numbered 2,231, of whom 410 were passengers, 75 being hurt from preventible causes.

During the year 200 fires were reported as having started within 300 feet of railway tracks, and 164 were credited to trains. A total of 25,148 acres were burned over, entailing a loss of $88,480.

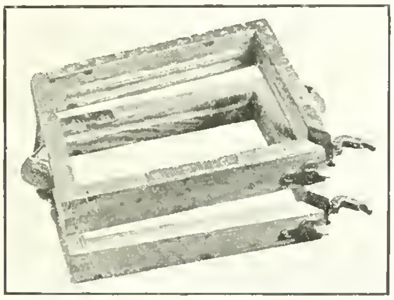
FOUNDRY PRACTICE AND EQUIPMENT

Practical Articles for Canadian Foundrymen and Pattern Makers, and News of Foundrymen's and Allied Associations. Contributions Invited.

THE "GUELPH" RIGID SNAP FLASK.

THE importance of a good, durable and rigid snap flask is fully realized by foundrymen, and the accompanying particulars concerning a snap flask designed and manufactured by the Guelph Pattern Works, Guelph, Ont., to secure these qualities are likely to prove of interest.

The ends are dovetailed, glued and nailed in two directions, while the corners are further strengthened by means of malleable iron corner brackets, extending $5\frac{1}{2}$ inches on each side, screwed on, and having lips on the under side which grip the flask firmly. The hinges are



"GUELPH" RIGID SNAP FLASK.

simple and are fitted with a large wearing pin. A special hook catch is used, the feature of same being its instantaneous and positive action.

The top and bottom edges are fitted with malleable iron strips secured with screws every $2\frac{1}{2}$ inches, and the trimmings generally are of high grade malleable iron. The lumber used in the manufacture of the "Guelph" rigid snap flasks is selected kiln-dried Georgia pine, $1\frac{1}{4}$ inches thick, although oak or maple is supplied when required.

BUILDING AND EQUIPMENT OF A MODERN PATTERN SHOP.

By Thomas Roberts.

IN most works where the staff of pattern makers is not large, it has been the practice to place these workers in any out of the way corner, or in some part of a gallery in the machine shop, but the insurance companies are now insisting on having them placed in a separate building, which in the writer's opinion is the proper thing to do. If possible they ought to be on the ground floor, so that the quick-running machines which they use will have no great amount of vibration.

The building should have side lights, as well as top lights, although the top lights need not be more than one-sixth of the roof. The height of the shop should be not less than 12 ft. at the sides, and if the comfort of those who have to work in it is considered, the floor ought to be of wood, not concrete or flags. It is here that the insurance company steps in. To them the comfort of the workshop does not matter; they have their own interests to look after.

Another matter is the ventilation of the workshop. If this is not given the importance it deserves we find that towards the end of the day the workers show pronounced signs of fag, and draughty windows and doors are thrown open with disastrous consequences to health. Again, where there is much sawdust, and a large number of machines throwing off dust, there ought to be a fan provided at one end of the room, and pipes to take away the dust.

The best ventilated and cleanest pattern shop the writer has worked in was fitted with a cyclone dust-collector fixed outside the building, with pipes attached to each machine to draw off the sawdust and cuttings. There were also pipes for the sweepers to brush the shop rubbish to, and the collector took away all sawdust, shavings, and waste, leaving the screws, sprigs, nails, and lost tools, which were brushed to the sump hole, to be picked up by the sweepers. The dust collector also acted as a good ventilator.

Equipment.

Coming now to the question of equipment, and in giving an opinion on this subject we take as our standpoint pattern shops with over 12 journeymen employed. The machines required to prevent time being lost by men being kept waiting are as follows:—

One circular saw to 15 men.

One band saw to 15 men.

One planing or thicknessing machine to 20 men.

One small hand trimmer to six men.

One large hand trimmer to 20 men.

One Wadkin pattern making machine where there is plenty of work for it.

One face-plate lathe where the pattern-making machine is installed.

One face-plate to 10 men where there is no pattern-making machine.

One hand planing machine.

One lathe on bed to six men.

One wet grindstone, one dimension saw.

One sand-papering machine where a dust collector is handy.

One medium-size drilling machine.

One small pillar drill with sockets to take brace drills.

One cast iron planed setting-out table with angle lines marked on, size about four feet square.

Two double glue pots.

Pattern-makers' Stores.

The pattern room stores for materials used in the workroom is a necessity, and if possible might be located near the centre of the room, care being taken that it is not an obstruction, and that it is handy for the workers. The storekeeper can fill in his spare time by making out time cards, and performing other small duties which would help the foreman in his clerical work.

Another convenience is a drawing stores, where the plans which are standard and kept for pattern shop use are placed in bundles of 50 for easy reference. This stores need not be a large one, but it prevents a waste of time. The cost is not great, and it is very cheaply made. A corner of the room should be reserved for pattern painters, and this should be where there is not much dust.

A complete set of work-tables for all workers in the room ought to be provided. There are also required band saw blade setting, sharpening and piercing machines. The man in charge of the tools will require to keep in stock extra knife blades for trimmers, planing machines, and extra pulleys for band saws, so that the machines are not stopped for any great length of time for repairs.

In a recently built pattern shop, the workers are placed on each side of the room where there is no glass in the roof; the middle part under the glass roof being clear for the making and altering of large patterns. The tools are arranged down one side of the centre part, so that they can all be worked from one line shaft, which is driven by a motor placed at one end of the room. All the benches are single benches, and can be moved about when a large space is required in any part of the room. The size of the room is 170 ft. long and 72 ft. wide and 12 ft. high at sides.—From a paper read before the Manchester Association of Engineers.

INDUSTRIAL NOTABILITIES--No. 19

"I BELIEVE that the psychological influence of enthusiasm is incalculable; and while I can scarcely claim to be the possessor of any extraordinary ability, yet perhaps enthusiasm has been the principal factor in my success." This is the admission of William McMaster, one of Montreal's most successful business men. He recently came prominently before the public by being appointed to the directorate of the Bank of Montreal.

His enthusiasm, however, brought him success in another field long before he became interested in banking. It made him an engineer, and the head of one of the largest steel plants in the Canadian Metropolis. When a boy, his parents were not able to give him a university education, but they gave him Scottish blood and those other qualities necessary to a man who is to make a success.

He was born in Montreal, and got his education at the old Collegiate School in that city. Still keeping up his studies, he entered the offices of Moreland, Watson & Co., where this quality—enthusiasm—got him transferred to the Montreal Rolling Mills, which this company controlled, and it was enthusiasm and hard work that made him successively sales-manager, secretary-treasurer, superintendent, and finally vice-president and general manager. When the rolling mills became incorporated in the Steel Company of Canada, he retired, and his son, R. H. McMaster, is now the manager. The Montreal Rolling Mills had, however, become under the management of William McMaster, one of the most important steel plants in Canada.

WILLIAM McMASTER.

He has been a power in various trade organizations. The Metal and Hardware Association elected him as president in 1891. He served upon the council of the Montreal Board of Trade in 1898 and 1899. In 1903 he became president of the Montreal branch of the Canadian Manufacturers' Association, and he was one of the influential body of delegates chosen to voice the views of the Dominion at the Commercial Congress of the Empire in London, England.

The widespread character of his influence is shown by the numerous companies of which he is a director. These include some thirteen of the larger commercial, manufacturing and financial concerns of Canada. One industry in particular he has done much to develop; viz.: the manufacture of explosives. He is also a director of the Dominion Iron and Steel Co.

He believes that it pays a young man to stick to one line of endeavor. The tendency to-day, he says, is for young men to throw up a fairly good position for one new and untried that offers for the moment a better salary. He is fond of sports, especially golf and yachting, and pastimes in which he himself can take part.

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Vol. XI. JANUARY 29, 1914 No. 5

PRINCIPAL CONTENTS.

THE COMING OF A GREAT INDUSTRY.

WHETHER our sentiments, convictions or polities be in line or otherwise, there is gradually being ushered in an era of Canadian history, in which ship-building and marine engineering—mercantile and naval, with their attendant and accessory industries, will contest and possibly usurp in importance those manufactures which at present occupy premier place in our national economy.

Evidence is available on every hand that an insistent and well-defined policy is being pursued by several powerful "Old Country" corporations interested in various departments of marine engineering and ship-building, towards the creation on our shores of enterprises of that nature, and while in some quarters little heed is being paid to such happenings as the prosecution towards completion of the plants of the Canadian Vickers', Ltd., and the Armstrong, Whitworth of Canada, Ltd., and to the purchase by Yarrow's, of Glasgow, of marine interests on the Pacific Coast, these are no less real and definite stages in the ship-buildingization of this Canada of ours .

A few months ago, we published not only a descriptive and comprehensive article covering the Vickers' plant at Montreal, but in addition gave official information concerning the near future date of its completion, including equipment for service. The plant of Armstrong, Whitworth of Canada, Ltd., which was described more or less briefly in our Annual Review Number, of date December 25, 1913, is meantime, of course, reputedly more or less of a tool steel proposition, but who believes that the Canadian market is so attractive for the disposal of that product as to warrant such a heavyweight corporation settling on our shores. The advent of Yarrow & Co., on the Pacific Coast is another step in the ladder, and the merging of our lake and river steamship companies into one gigantic combine, known as the Canada Steamship Lines, Ltd., makes provision for catering to the ship-building corporations as the enterprise develops. Irrespective of our views on a "Laurier Navy," or a "Borden Emergency," there is being scientifically and systematically developed a policy which will put Canada in a place of honor relative to the industries of ship-building and marine engineering, and when economic conditions are considered, who is there that can reasonably find fault?

The world's ship-building and marine engineering returns for 1913 are now public property, and, as anticipated, constitute a record. As was to be expected, Great Britain again takes premier position in tonnage launched, and engine horse-power installed. It is, however, worthy of note that other countries have shown considerable development and progress, both in the number and size of the vessels launched. We in Canada still occupy a somewhat obscure place in the record, and were it not for the preparations now being made, there would be little hope of our getting much higher up. Strenuous efforts are being put forth in the United States to raise the production standard of its ship-building and marine engineering, although little success is as yet apparent, and emulating as we do our American brethren in so many other directions, we might do worse than follow their example in propagating these twin industries in our own land.

Over-much is made of the cost of labor in Canada when compared with Great Britain, for after all, the difference against us is of little moment. During the year just gone, labor troubles in the matter of "strikes" did some material hurt, but these were really insignificant when the matter of "broken time" falls to be taken into account. In the shipyards and engineering works of the "Old Country," particularly the former, the "broken time" feature amounts to a positive curse, and had it not been for the unprecedented extent to which it attained during 1913, the output record would have been increased by many thousand tons.

Many men work from two to four days a week only, yet earn in most cases sufficient for the purpose of a livelihood to themselves and those dependent. If these men stuck to their work as, we are glad to say, our Canadian operatives do, then the wage preponderance in favor of Canada would entirely disappear, and the bugbear of high production cost with it. This feature is not being lost sight of in the planning of ship-building plants on our shores, and with the materials of construction costing little more, there is no drawback to the forward progress of the Canadian ship-building industry.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3....	20 00	21 50
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3.......	20 00	22 00
Clarence, No. 3........	20 50	21 00
Jarrow	.....	23 50
Glengarnock	......	26 00
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1........	19 40	18 35
Victoria, No. 2X	19 15	18 10
Victoria No. 2 Plain ..	18 90	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh.........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal......	2.10
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh.....	1.20
Steel hoops, Pittsburgh..........	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base..	$2 15	
Cut nails	$2 60	2 65
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ in., 100 lbs...	$2 30	$2 20
Heads, per 100 lbs.......	2 55	2 55
Tank plates, 3-16 in......	2 60	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	9 00	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate Washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb off
Nuts, Hexagon, all sizes..	4½ per lb off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright	....85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, bronze	....70, 10, 7½, 10 p.c. off

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in...	75%
Finished Nuts over 1 in....	72%
Semi-Fin. Nuts up to 1 in..	72%
Semi-Fin. Nuts over 1 in...	72%
Studs....................	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 00	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncr'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings..	9 00	9 00
No. 1 wrought iron.....	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	13 00	12 00
New brass clippings....	8 50	8 75
No. 1 brass turnings....	7 25	7 50
Heavy lead	3 75	4 00
Tea lead	3 00	3 00
Scrap zinc	3 00	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$. 32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	.....	....	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in. ..	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$16 00	$16 25
Electrolytic copper	15 75	15 75
Casting copper	15 25	15 50
Spelter	5 25	5 25
Tin	40 00	40 50
Lead	5 15	5 40
Antimony	8 50	8 50
Aluminum	21 00	19 00

SHEETS.

	Montreal.	Toronto.
Sheets, black, No. 28	$2.75	$2.70
Canada plates, ordinary, 52 sheets	2.75	2.75
Canada plates, all bright	4.00	4.15
Apollo brand, 10¾ oz. (American)	4.30	4.20
Queen's Head, 28 B.W..G.	4.40	4.40
Fleur-de-Lis, 28 B.W.G.	4.20	4.25
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.40	4.40

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.26
Benzine, per gal.	23½
Pure turpentine	0.60
Linseed oil, raw	0.60
Linseed oil, boiled	0.63
Plaster of Paris, per bbl.	2.10
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Jan. 26, 1914.—The machinery trade continues to show an improved tone, and conditions are considerably better than they were a month ago. However, business is not yet by any means as good as dealers would like to see it, and orders actually booked during the last few weeks have all been small.

The demand for steel bars and pig iron, also for plates, is quite brisk just now, and good orders are being received. These, however, are all for present requirements, it being too early yet to look for spring enquiries. Business in old metals, on the contrary, remains very quiet, and prices quoted are merely nominal.

The Canadian Society of Civil Engineers will hold their twenty-eighth annual meeting here January 27 to 29. The first day will be occupied by business sessions and an address by the retiring president (Mr. Phelps Johnson, of the Dominion Bridge Co.). In the evening a smoking concert will be held. On January 28 a visit will be paid to the works of the St. Lawrence Bridge Company at Rockfield, where the progress of the various members of the Quebec Bridge will be inspected. In the evening the annual dinner of the society will be held at the Engineers' Club. On the final day the announcement of the results of the election of officers and members of council for 1914 will be made, and the final business session will be held.

On Saturday last, Montreal's annual automobile show was opened at the Craig Street Drill Hall, and will last a fortnight. The present week is devoted to pleasure cars, while next week a large number of representative motor trucks will be on view.

A press despatch to-day from Sydney, N.S., states that the plant of the Dominion Iron and Steel Co. reopened this morning after being closed down two weeks for repairs. It is said that there are sufficient orders on hand to keep the plant busy until well into the summer. Orders received for rails some time ago from the C. P. R. and I. C. R. are being rushed, and, as soon as these are finished, a commencement will be made on the order for rails lately received from the Australian Government.

Toronto, Ont., Jan. 27, 1914.—The Toronto "Globe" greeted this city yesterday morning with a big headline on its front page announcing that:—"Steel, The Barometer, Shows A Rising Sun." A cable from the Globe's special correspondent in Pittsburgh stated that steel orders were coming in rapidly, and that in ninety days, the mills would be running to capacity again. The market here was unmistakably more cheerful, and no manufacturer need now hope to make contracts ahead at the old price—$1.20 f.o.b., Pittsburgh. Some of the larger sources of supply this week have been asking an advance of a dollar a ton covering second quarter deliveries. This means that for the first three months manufacturers expect to be fairly slack, but they are sure that after March, things will be better. They are not going to do as some steel makers did two years ago when conditions were dull. In that year, several concerns booked orders ahead at their low rate and were selling steel bars at $1.10 when others were getting $1.40.

It is very pleasing to learn that orders for steel placed in the city during the past few days have exceeded by far the amount placed for many a day.

A certain Canadian steel company that buys its billets and skelp from the United States Steel Corporation was informed this week that the price of the latter's product was about to go up, and were given twenty-four hours in which to get in and buy. The inducement was effective. The Canadian company placed a very big order.

A prominent Toronto agent believes that the mills will be working full again by July. People have been hesitating, he says, with the hope that steel might get cheaper, and have decided that it won't; so they are buying. The market is strengthening as a result, and is changing from a buyers' to a sellers' market. While local manufacturers generally are buying, it is the structural men who have effected the change in conditions. More new propositions are being talked about than for some years, and people are preparing to spend money.

Pig Iron.

Another very promising sign is that foundries are taking an increased amount of pig iron, and that the market is strengthening. The two largest makers of pig in Ontario are reported to be doing considerable business.

Machine Tools.

The feeling in the machine tool market is distinctly better, though no big sales of tools are reported. The Detroit office of the Michigan Central Railway advises that the recommendation of the mechanical department re machine tools required for the St. Thomas shops, have not been received. The H. Mueller Mfg. Co. have purchased two large Hendey lathes this week for their Sarnia plant. The Electrical Steel & Metals Co., Welland, who have been in the market for machine tools, have bought a considerable quantity, mostly second-hand, and a crane from the Toledo Crane Co. The Galt Knife Co., Galt, Ont., recently organized by Thos. Vair, bought a lathe and punch last week. The Dominion Power & Transmission Co., Hamilton, are considering the purchase of an electric crane for their new power house.

Metals.

Tin rose a half a cent a pound. Copper rose only slightly. There have been a few more inquiries, which show that the market is stirring. There have been no sales of scrap iron.

James A. Coulter, president and general manager of the John Morrow Screw and Nut Co., Ingersoll, Ont., was a candidate for municipal honors at the recent election in Ingersoll. He received the largest vote of any councillor. In 1907-8 he was Mayor of the town.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Bradford, Ont.—A carload of machinery has arrived from Toronto for the Watson, Limited, new plant.

Hamilton, Ont.—The Tallman Brass Co. propose to make additions to their factory at a cost of about $15,000.

Victoria, B.C.—It is reported that the Canadian Steel Studding and Mfg. Co. will erect a new factory estimated to cost $25,000.

Midland, Ont.—The machine shop of Jas. Wilkinson on the dock took fire on Sunday, January 18, destroying the frame and roof.

Elk Lake, Ont.—Twelve team loads of machinery for the Mapes-Johnston Mine left Elk Lake on Friday en route from the Montreal-James Mine.

Edmonton, Alta.—Gorman, Clancy & Grindley, manufacturers of builders' supplies, will buy engine, boiler, pumps, etc., to present to the Technical School.

Calgary, Alta.—It is reported that the Merryweather Co., London, England, will erect a factory here, to manufacture fire apparatus. The factory will cost $250,000.

Bridgeburg, Ont.—Tuttle & Bailey Mfg. Co., New York, makers of registers, ventilators, etc., who proposed to erect a plant here, advise that their plans are still indefinite.

Edmonton, Alta.—The Edmonton Iron Works, Ltd., machinists, iron and brass founders, etc., state that they are making alterations to their plant, but will not be buying machinery.

Vancouver, B.C.—The Tillsonburg Electric Car Co., Tillsonburg, Ont., are reported to be contemplating the erection of a branch plant in the West, if offered a site, power, and exemption from taxation.

Morrisburg, Ont.—The Morrisburg & Ottawa Electric Railway Co. are trying to get possession of an unused sheet-steel mill at Morrisburg for the manufacture of steel of different kinds, and for the construction of electric cars.

Hamilton, Ont.— The Schacht Motor Car Co. will discontinue business here. F. L. Reid, manager, states that someone else will probably handle the repair department, and that the factory will not remain idle.

Edmonton, Alta.— Equipment for instructing electrical workers and prospectors is being purchased. With the exception of four engine lathes and one shaper all the equipment for the machine shops has arrived.

Fort William, Ont.—A committee of the Board of Trade, consisting of J. P. Jones, S. C. Young, J. T. Horne, W. A. Dowler and the president will endeavor to secure Government assistance towards the building of an ore dock at this point.

St. Mary's Ont.—The new addition to the Richardson foundry is now completed. It is a substantial stone structure, 2½ storeys high. The Company do a large business in dairy utensils. A considerable quantity of new machinery will shortly be installed.

Vancouver, B.C.—Wilson & Perry, assignees, 336 Hastings St., W., are calling tenders for the stock and machinery, consisting of lathes, drills, shafting, belting, electric motors, etc., of the Gourlay Machine Works, 1112 Albert Street, Vancouver.

Port Arthur, Ont.—The Conley Frog & Switch Co., the parent plant of which is in Memphis, Tennessee, will start building their Canadian branch plant here in the spring. Mr. Conley will be here shortly to make all arrangements. They will manufacture railway supplies.

Port Arthur, Ont. — An iron claim, eight miles from Rosmere Station on the C.N.R., was sold last Saturday for $100,000. The claim was sold by Colonel Little, of Port Arthur, to a syndicate said to be composed of outside capitalists. A drill is to be put on the property at once and the extent of the deposit ascertained. Judging from samples already analyzed, it is very rich.

Exeter, Ont.—The Exeter Manufacturing Co. have been securing machinery and supplies for the plant recently acquired by them, and have started operations. This firm was recently incorporated with a capital of $20,000 to take over the business previously conducted by James Murray & Son, Exeter. They will make bells, roadmaking tools and machinery, cast iron pipes, pumps and other specialties.

Hamilton, Ont.—The Willys-Overland of Canada, Ltd., will take over the factory of the Schacht Motor Car Co., and, after making necessary extensions and changes to accommodate their requirements, will start the manufacture of cars. J. N. Willys, the president, is also president of the Willys-Overland Co. of Toledo, Ohio. The capital of the new company is $500,000. The directorate and staff will be announced shortly.

Winnipeg, Man.—L'Air Liquide Society, Paris, France, with plants at Montreal and Toronto, will commence the erection of a plant costing $60,000 this spring, at 325 William Ave., Winnipeg. P. E. Wicke, Montreal, has charge of the work. In this plant they will manufacture oxygen, nitrogen, and liquid air. The equipment will be similar to that at Toronto, which consists of purifying apparatus, air compressors, electric motors, and a machine shop. They will also carry a complete line of oxy-acetylene welding and cutting outfits.

Welland, Ont. — Contractors on the new Welland Canal have purchased a considerable quantity of machinery. Baldry, Yerburgh, & Hutchinson, St. Catharines, contractors for Section 2, have bought some machinery used on the Panama Canal. The Dominion Dredging Co. on Section 1 have started excavating and dredging with 200 men, while two steam shovels will start on Section 2 next week with 50 men. O'Brien & Doughney, on Section 3 have 500 men, and are cutting down a hill. The Canadian Construction Co. on Section No. 4 will not begin work until spring. Yale & Reagan, St. Louis, Mo., who have a sub-contract on No. 2, moved their plant up last week.

Electrical

Lambeth, Ont. — An agitation for Hydro-Electric power is to be begun.

Waubaushene, Ont.—Steps are being taken towards securing electric light for the village.

Wyoming, Ont.—The Town Council requires a new dynamo and additional electric lighting equipment. H. G. Taylor, clerk.

Prince Rupert, B.C.—The hydro-electric agreement, involving the giving of franchises to a private corporation, was beaten at last week's election.

Welland, Ont. — The Welland Electrical Co., are making extensions in Crowland and Pelham, while an extension into Humberstone is contemplated.

Ship-Building Plant of M. Beatty & Sons, Ltd., Welland, Ont.

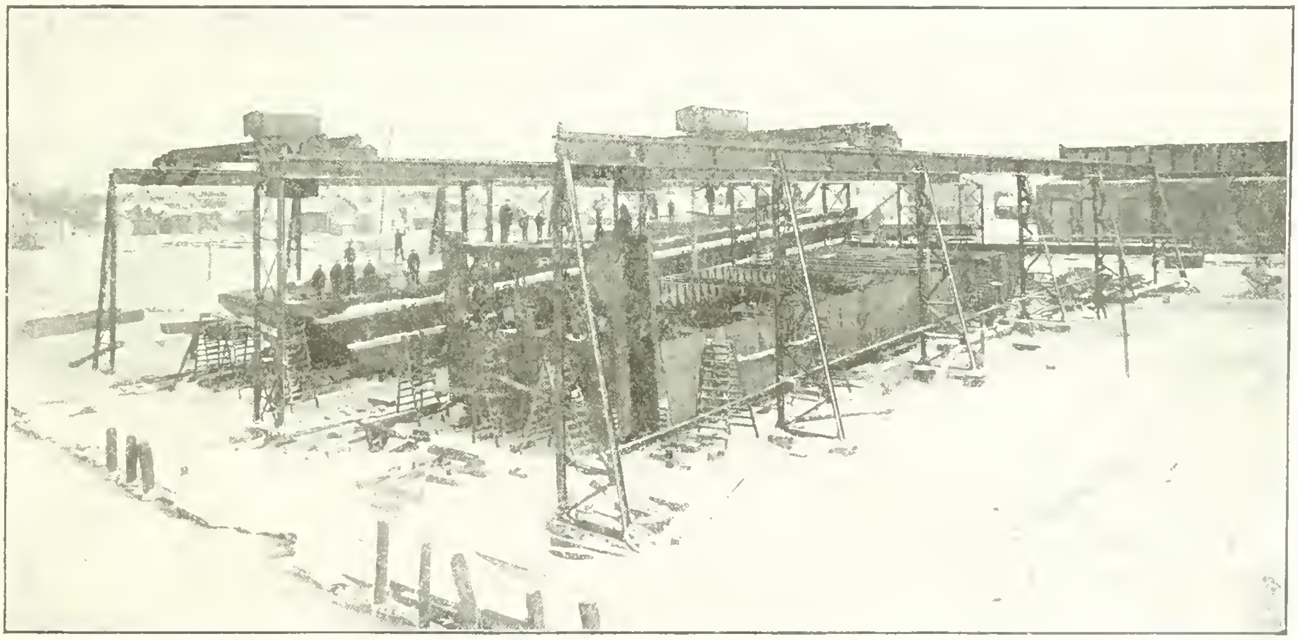
Staff Article

The development of the Canadian ship-building industry on our Great Lakes will necessarily be synonymous with the coming into larger prominence of the firm of M. Beatty & Sons, Ltd., Welland, Ont., and a perusal of the accompanying description of the Beatty plant will be sufficient evidence that their location and equipment are not only prepared for opportunity, but are contributory to it.

IN the year 1862 the firm of M. Beatty & Sons was established at Welland, Ont., for the purpose of carrying out shipbuilding and general engineering work. The volume of business became greater than the old plant could take care of, so a site covering about 12 acres was purchased in Welland, alongside the canal, a new plant erected and manufacturing commenced in 1906. The location for a plant of this description is good, being on the highway between the Great Lakes and the St. Lawrence River, and also being connected with the Grand Trunk Railway System. Cheap power is also available from the Cataract Power Co.

General Layout Features.

All the buildings are of reinforced concrete construction and of modern design. They are well equipped to take care of the various products manufactured by the Company which include dipper dredges, steel scows, drill boats, hoisting engines, power derricks, etc. The buildings are amply large to allow for a considerable expansion in the volume of business, and are equipped for the introduction of new specialties when desired. There are at the present time two shipbuilding berths in service, and a new berth is in contemplation, on the completion of which it will be possible to build ships suitable for trading on the Great Lakes. A standard gauge industrial track system connects the various shops with each other and also with a siding from the G. T. R. main line. This system in conjunction with the layout of the various buildings, considerably facilitates the handling of both raw materials and product, thereby keeping operating expenses down and increasing the efficiency of the whole organization.



VIEW OF SHIPYARD FROM WELLAND CANAL—M. BEATTY & SONS.

Shipbuilding Plant.

As already stated, steel scows and dredges form the most important products in the shipbuilding department. For the production of these, there are two berths, each being 270 ft. long by 50 ft. wide, and equipped with an overhead hand-operated traveling crane having a capacity of 10 tons and a span of 50 ft. The cranes operate the full length of each berth and were supplied by the Shaw Electric Crane Co., Muskegon, Mich. The berths lie at right angles to the canal and have sufficient slope for launching purposes. In the yard adjoining the berths, plates and structural steel are stored. Here, also, is installed a hand-operated gantry which operates over a standard gauge track. Compressed air is piped to connections located at various points near the berths and several rivet-heating furnaces are installed.

Boiler and Blacksmith Shops.

Alongside the shipbuilding berths is the boiler shop which is 200 ft. long by 60 ft. wide and has a standard gauge track running down the centre. In this shop all plate and other heavy work is done in connection with the shipbuilding plant and a part is used for laying out the moulds. The boilers for the hoisting engines are made in this shop.

The equipment in the boiler shop consists principally of two 10-ton hand-operated overhead travelling cranes made by the company; a "Hanna" pneumatic riveter with a 10-ft. reach and capable of exerting a pressure of 90 tons. This machine is used principally for boiler work. For bending plates there is a set of plate rolls 9 ft. 6 ins. long, made by the company. There is also a horizontal 42-in. plate punch and a "Bertram" 12-ft. radial drill. Jib cranes are installed with the larger machines.

The blacksmith's shop adjoins the boiler shop and is 100 ft. long by 50 ft. wide. In this shop are six fires equipped with an exhaust system for carrying away the smoke, etc., and in connection with this system is a motor-driven

"Sheldon" fan. At each fire is installed a jib crane equipped with a Yale & Towne one-ton chain block. There is also a 50-ton "Chambersburg" steam hammer, a "Champion" power hammer by the Beaudry Co., Boston, Mass.; and a bar shear capable of handling stock up to $1\frac{3}{4}$ inches square and 2 inches round, supplied by the New Doty Mfg. Co., Janesville, Wis.

Adjoining the blacksmith's shop and at the south side are two storages, one on each side of the track. These are used for storing bars, etc., and steel plate respectively.

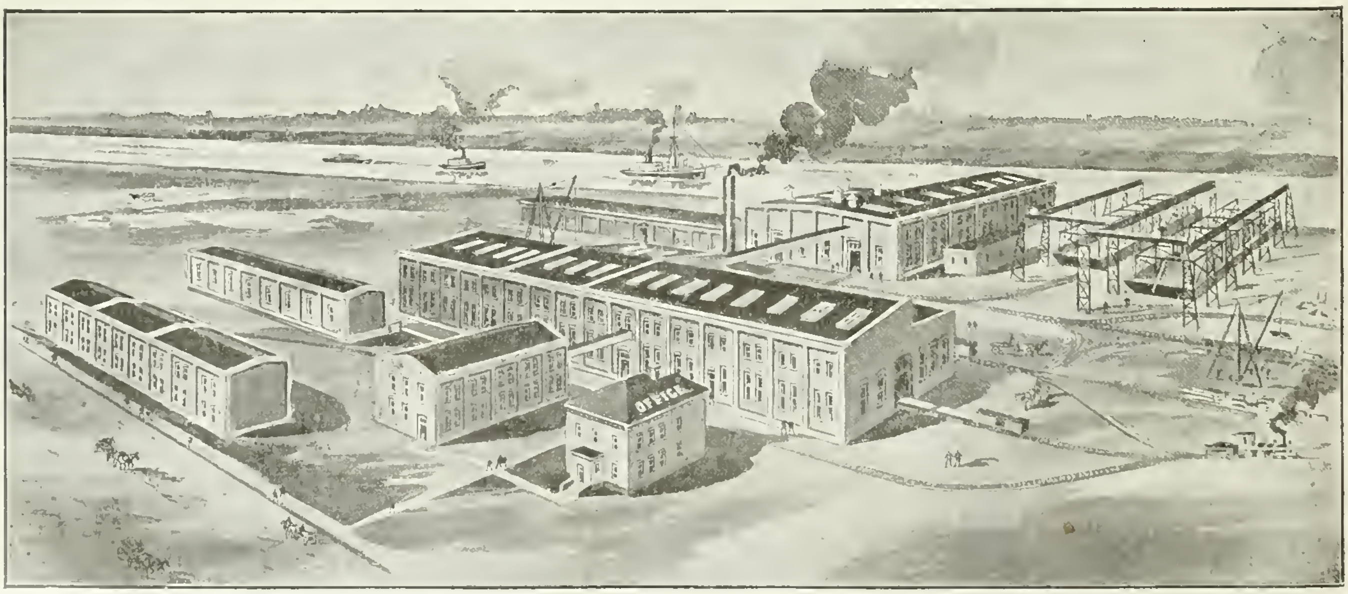
Machine Shop.

The machine shop is a substantial reinforced concrete building 160 ft. by 90 ft. It is divided into two bays, the main bay being 50 ft., wide and the side or west bay 40 ft. wide. Steel columns carry the crane tracks over the main bay, the distance from floor to the crane rails being 20 ft. The "Niles" crane is operated by 220 volt D.C. motors, and has a capacity of 15 tons with a span of 50 ft. A standard gauge track runs the full length of the main bay and connects with another track entering the shop at the end, from the west side and connecting with the boiler shop.

The west bay is 40 ft. wide and has a clear height of about 18 ft. At the north end are the tool stores and wash room, the rest of the floor space being utilized as a machine shop where are installed the lighter machine tools with a bench for fitters along the wall. The tools for the heavier work are installed in the main bay, in the centre of which the hoisting engines are assembled. The hoisting engines are made either with or without boilers to suit customers' requirements. There are a number of jib cranes installed throughout the machine shop, all equipped with Yale & Towne chain blocks.

The machine shop is well equipped with a number of modern machine tools designed to use high speed steel. The principal tools include a 100-inch vertical boring mill supplied by John Bertram & Sons Co., Dundas, Ont.; a 42-inch engine lathe by the London Machine Tool Co., London, Ont.; a 48-inch x 20-ft. Bertram planer; a 72-inch Bertram radial drill and a 42-inch radial drill

INTERIOR OF MACHINE SHOP—M. BEATTY & SONS.



BIRD'S-EYE VIEW OF PLANT M. BEATTY & SONS.

by the Cincinnati Bickford Tool Co., Cincinnati, Ohio. These machines all have individual motor drives, while the smaller tools are driven from the main line shaft which in turn is driven by a 40-h.p. Canadian Westinghouse 220-volt a.c. motor. The smaller tools include principally 24-inch and 28-inch engine lathes supplied by the Gisholt Machine Co., Madison, Wis.; No. 4 and No. 5 "Cincinnati" milling machines; a 20-inch shaper by the same company—the Cincinnati Milling Machine Co.; a Bertram 72-inch horizontal boring mill and a 22-inch Lodge & Shipley lathe.

Foundry and Core Room.

Adjoining the south end of the machine shop is a building 53 ft. long by 90 ft. wide with a standard gauge track running down the centre and connecting with the machine shop. On the east side is a general store room and on the west side is the cleaning room.

On the south side, and a continuation of the same building is the foundry and core room. The foundry is 100 ft. long and 60 ft. wide, while the core room on the west side is 80 ft. long by 30 ft., wide. The cupola room at the north end of the core room is 20 ft. x 35 ft. In the foundry are two 10-ton electrically operated "Niles" cranes with a span of 60 ft., and operating over the full length of the building. There are two ovens in the core room, each 15 ft. wide, by 30 ft. deep. They are equipped with "Kinnear" rolling doors and are heated with natural gas. There is an overhead runway in connection with each oven, equipped with 1-ton Yale & Towne chain blocks. Adjoining the core room is a 36-inch "Whiting" cupola, and the charging floor is served by a "Beatty" electric hoist and conveyor.

The pattern shop is situated near and on the east side of the foundry. It is 90 ft. long by 50 ft. wide. This shop, like the others, is of reinforced concrete construction and has a floor above, which is used as a lumber storage. The equipment includes an overhead hand-operated travelling crane equipped with a 2-ton Yale & Towne Triplex block; a 12-inch buzz planer; a 26-inch surface planer; a 36-inch band saw; rip saw, etc. A number of these machines were supplied by the Canada Machinery Corporation, Galt.

Power Plant.

Power rates being comparatively low, the company use outside power entirely which is obtained from the Cataract Power Co. The current is stepped down from 2,200 volts to 220 volts by three 200 K.W. Canadian Westinghouse transformers located in the transformer house adjoining the power house. The power house contains the air compressors and a Canadian Westinghouse motor generator set which supplies D.C. current at 220 volts to the crane motors. This is an 85 K.W., 3-phase machine running at 766 R.P.M. The switchboard was supplied by the Canadian Westinghouse Co., and has 3 panels equipped with an ammeter, 2 voltmeters, 2 oil circuit breakers, an integrating watt meter and switches.

A considerable amount of compressed air is used throughout the plant, and for taking care of this service, three Canadian Rand air compressors have been installed. The largest of these machines is a cross compound compressor with air cylinders, 12 in. and 20 in. diameter, by 18 inch stroke. It has a capacity of 1170 cu. ft., of free air per minute against a pressure of 100 pounds at 180 R.P.M., and is driven by a Canadian Westinghouse 200-H.P., 220 volt A.C. motor, running at 625 R.P.M. Another compressor has air cylinders, 9 inch and 14 inch diam., by 12 inch stroke, with a capacity of 320 cu. ft. of free air per minute against a pressure of 100 pounds, and runs at 150 R.P.M. This machine is driven by a 75-H.P., 220-volt, A.C., Canadian Westinghouse motor. The third compressor has air cylinders 8 inch and 12 inch diameter, by 12 inch stroke with a capacity of 250 cu. ft. of free air per minute against a pressure of 100 lbs. at 160 R.P.M., and is driven by a 60-H.P. 220-volt A.C. Canadian Westinghouse motor. The compressors are all of the horizontal cross compound type, the cylinders being fitted with Corliss inlet valves and poppet outlet valves.

Adjoining the power house is the boiler room which contains a 100-H.P. Robb Mumford horizontal return tubular boiler and a Sturtevant duplex 5¼-3½-5 inch boiler feed pump. The boiler provides steam for the ventilating system, heaters, fan engine, and for heating the offices.

Heating and Ventilating.

The ventilating system was supplied by the B. F. Sturtevant Co., Boston, Mass., and is located on the floor above the store room. The system consists of a 10-ft. diameter steel plate fan driven by a 10-H.P. vertical Sturtevant steam engine, and five sections of heating coils supplied with live steam from the boiler. The piping is arranged so that each section is controlled independently of the others in order to obtain a variation in the final temperature in the shops according to the outside temperature. The warm air is carried in galvanized iron ducts to the various shops where it is distributed by branches leading from the main duct. Electric light is installed throughout the shops which are equipped for the most part with 100-c.p. tungsten lamps.

General Features.

Other buildings include a storage, 130 ft. by 35 ft., for hoisting engines. This is located at the south-east section of the plant. A building of similar dimensions is used for a pattern storage. Near the main road is the office building which is two storeys high. On the ground floor are the private and general offices, while the drawing office is on the floor above.

TENSION ON CYLINDER COVER STUDS.

By J. H. Rodgers.

IN the September, 1909, issue of The Power House a question of steam pressure was brought before the readers, and, after having been discussed for three or four months, the matter was shelved. As the topic involves much that is of interest to mechanics, I beg to submit the following for consideration:—

The question as originally stated by Mr. Jones was as follows:—If we had a cylinder cover secured to the cylinder by ten studs, each screwed up to a tension of 1,000 lbs., and if the face of the cover has an area of 100 square inches in contact with the steam, would there be an increased tension on the studs if steam were admitted into the cylinder at 80 lbs. per sq. in.? Mr. Jones thinks there would be no increased tension until the pressure in the cylinder exceeded 100 lbs. per sq. in., and, while I do not agree with him or other readers with a similar theory, I am open to conviction. We are all readers of The Power House to learn and benefit by the articles which appear therein.

Mr. Orr, in the December, 1909, issue, believed that the tension on the studs does increase. He brought before us another question, an offspring of the original, which I believe has not yet been discussed through these pages: "Does the pressure of the steam against the inside of a cylinder cover lessen the screwing-up pressure with which the studs hold the cover against the cylinder end?"

The Writer's Theory.

The accompanying sketch will, I hope, bring to the readers my theory of the above two questions, and for convenience of illustration, only two studs are dealt with, the ultimate total result being obtained by multiplication. In the figures a cover and section of cylinder are shown. Fig. 3 has the stud nuts (a) screwed up against the cover by hand, leaving no tension on the stud except the weight of the cover, which in this instance need not be considered.

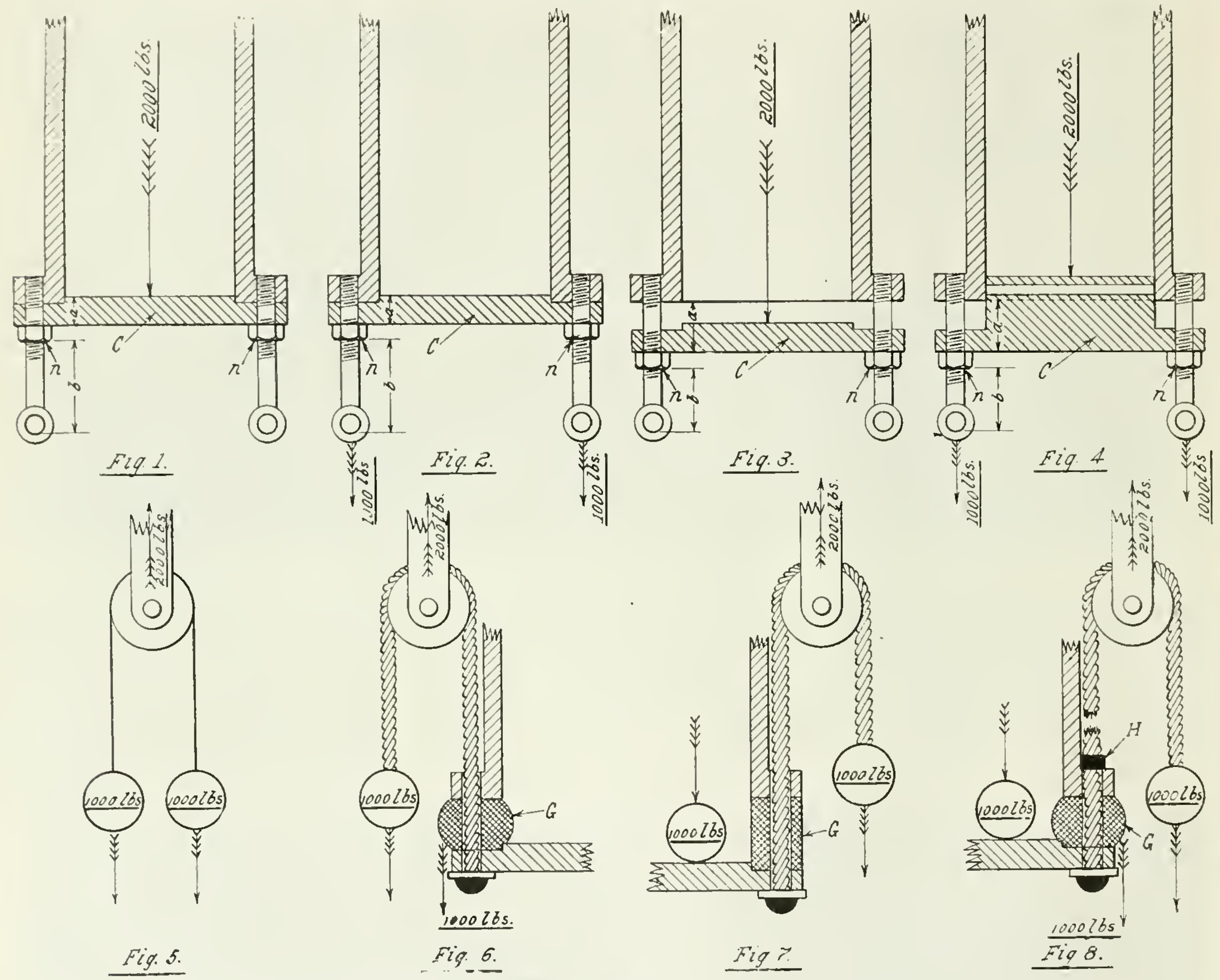
If a weight or pressure of 1,000 lbs. per stud, or 2,000 lbs. for two studs, acts on the inside face of the cover, the portion (a) of the stud is under a tension of 1,000 lbs., but the portion (b) is under no tension. Now, remove the 2,000 lbs. weight or pressure and tighten the nuts

(n), so that there is a tension of 1,000 lbs. on each stud between the nut and the cylinder end; then hang a weight of 1,000 lbs. on each stud, as shown in Fig. 2. Previous to the weight being applied, there was no tension at (b), but now there is 1,000 lbs. at both (a) and (b), which leaves the nut (n) free to move, also the cover.

Again, if the weights are removed from the eyes of the studs and placed on the cover, as in Fig. 1, there should be 4,000 lbs. tension on the two studs at (a), that is, 1,000 lbs. due to the are supporting 2,000 lbs., the rope is only under a tension of 1,000 lbs.

In Fig. 6, one of the weights is removed and the rope secured to a washer below the cylinder cover, the gasket (G), enlarged to show the action of compression and extension, being placed between the cover and the cylinder end. The gasket under compression exerts a pressure tending to force the cover away from the cylinder, but is prevented by the tension in the rope or bolt. Now, if a weight equal to the tension in the rope be placed upon the cover, as in Fig. 1,000 lbs. Now, place the weight or pressure on the cover, and the tension on the rope or bolt will be 2,000 lbs. If a weight of only 15 lbs. be placed on the cover, the tension will be 1,015 lbs. This is what I understand from Newton's Third Law of Motion:—"To every action there is always opposed an equal an~ contrary reaction."

If the tension of the bolt exerts a force to keep the cover against the cylinder, then the compression of the cover, gasket and cylinder end exert a like force to separate the head and the nut of the



TENSION ON CYLINDER COVER STUDS—DIAGRAMMATIC REPRESENTATION.

pressure of each nut and 2,000 lbs. on the cover. This is more clearly shown in Fig. 4, for, while the tension on each stud at (b) is only 1,000 lbs., at (a) the tension is 1,000+half the weight on the cover, or 2,000 lbs. If the weight on the cover were only 10 lbs., the portion (a) of each stud would have a tension of 1,000+half the weight on cover, or 1,005 lbs. In the above four illustrations the compression of the gasket and flanges are not considered. Fig. 5 shows a simple pulley supporting two weights, so that while the pulley, bracket and pin 7, the pressure of the gasket due to compression would force the cover away from the cylinder until the gasket (G) was free, but the rope retains a tension of 1,000 lbs.

Suppose we only place a weight or pressure of 100 lbs. on the cover, the compression of the gasket will be reduced one-tenth, and the pressure due to compression will only be 900 lbs. If the rope, as in Fig. 8, be secured as at (H), while the gasket is in compression, and the rope cut, or replaced by a bolt, the gasket would still exert a force of bolt, or the nut and opposite end of the stud; therefore, any additional pressure on the cover from the inside must be counteracted by an equal force, and if the studs do not take this extra pressure, what does?

I am not positive that the foregoing reasoning is correct, and I hope that some readers will kindly describe and illustrate their theories, and have them published for the benefit of mechanics at large, as the question seems to be of considerable interest to a wide circle of readers.

The World's Shipbuilding and Marine Engineering in 1913

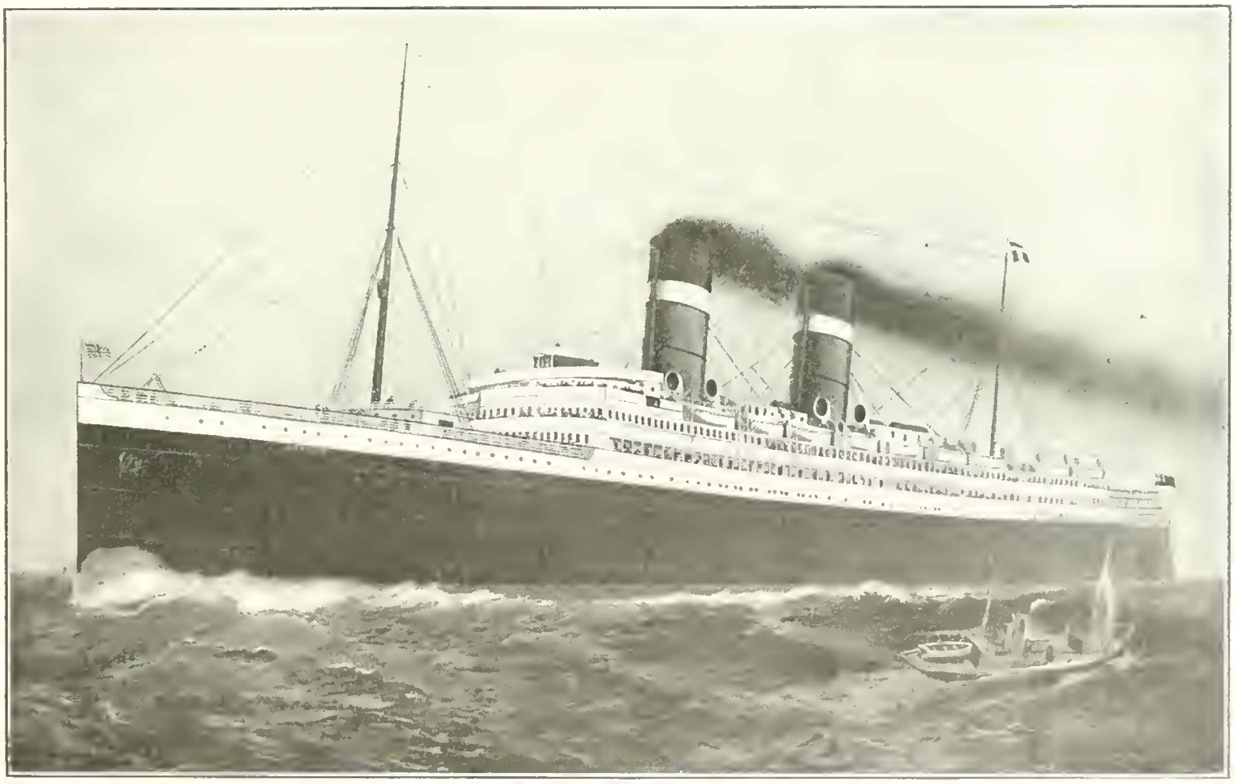
The extraordinary development and progress here recorded in the twin spheres of shipbuilding and marine engineering over a world-wide area are to say the least, remarkable, and to us who are citizens of the Dominion of Canada, there is borne home forcibly the insignificance of the contribution made, also the material loss through the indifference displayed towards the propagation of these and their co-related industries.

THE British Empire and particularly that section of it so familiarly dubbed "The Old Country," still maintains its place and prominence in the realm of shipbuilding and marine engineering. It is only natural, therefore, that such data and statistics as are available concerning the "Motherland," her colonies and dependencies, relative to the foregoing industries should be given their rightful setting. It should be noted, however, that development and achievement, and even record, are not being monopolized by Great Britain, but that strenuous and sustained effort in these directions by other countries is becoming each year more apparent. We in Canada have not yet become sufficiently enthused with, nor do we yet realize the importance to our commercial and industrial standing among the civilized and progressive nations of the world what due regard to the establishment and nurture of shipbuilding, and marine engineering would accomplish for us. The observations, data and illustrations which follow, and which have been gathered from a variety of authoritative sources, are such as to fill us with pride because of the work of our kinsmen, and to arouse within us the desire, in the early future, to develop along similar lines.

Prosperity the Keynote.

Prosperity is the note which sounds through all the records of the trade of 1913. In practically every branch of industry activity was limited only by the capacity of plant. During the preceding two years the trade conditions were of a highly favorable character, but satisfactory as these were, they were surpassed by those which prevailed throughout the year just closed, and it may be safe to assume that 1913 marks the highest level of prosperity to which the trade of Great Britain has yet attained. It would be ungrateful to quarrel with the result of the year's working, but in certain branches of industry the progress made would have been even greater had it not been, paradoxical as it may seem, checked by its own prosperity. Labor trouble in the sense of actual strikes loomed less large than it did in 1912, but many employers had to contend with a difficulty scarcely less demoralizing than strikes and infinitely more troublesome to remedy—that of broken time.

While the various industrial centres were employed to their full capacity, the measure of activity is not reflected altogether in profits. Consideration has to be given to the increased costs of working, particularly with regard to material, labor, and the higher rates ruling for money employed in the financing of industrial enterprise. Even when allowance is made for these, the net result of the year's work can scarcely be other than gratifying to the great majority of those engaged in commerce and industry. While the year, taken as a whole, was profitable, it was apparent during the latter two months that the crest of the wave of prosperity had been surmounted, and that the demand is less urgent now than it was. The reductions in the price of material which were made recently are probably the best indication of the trend of affairs, but notwithstanding the falling off, the industries of the country are still enjoying a measure of activity which we would be glad to believe could be maintained throughout the present year.



NEW ALLAN LINE STEAMSHIP "ALSATIAN."

In the Shipyards.

Coming to particular trades, it will be noted from the statistics and comments in later pages that the great industry which looks to the Clyde, not only as its birthplace, but as the principal centre of its activity, had a remarkably successful year. The success was more marked on the Clyde than anywhere else, but it was quite apparent in other British districts and in every country which is attempting to encourage shipbuilding in legitimate ways, and where financial conditions did not handicap the industry in its competition for new work. There was never any doubt as to the genuine nature of the many demands for new tonnage, or as to the ability of the shipbuilding and marine engineering firms to supply that demand, and it was not until there came a falling off in the freight market that owners and builders became less active in their negotiations regarding orders for new ships. With that falling off a reduction in the volume of work on hand in the yards was anticipated, but sufficient time has not yet passed to allow freights to affect seriously the activity of the many firms engaged in turning out new ships.

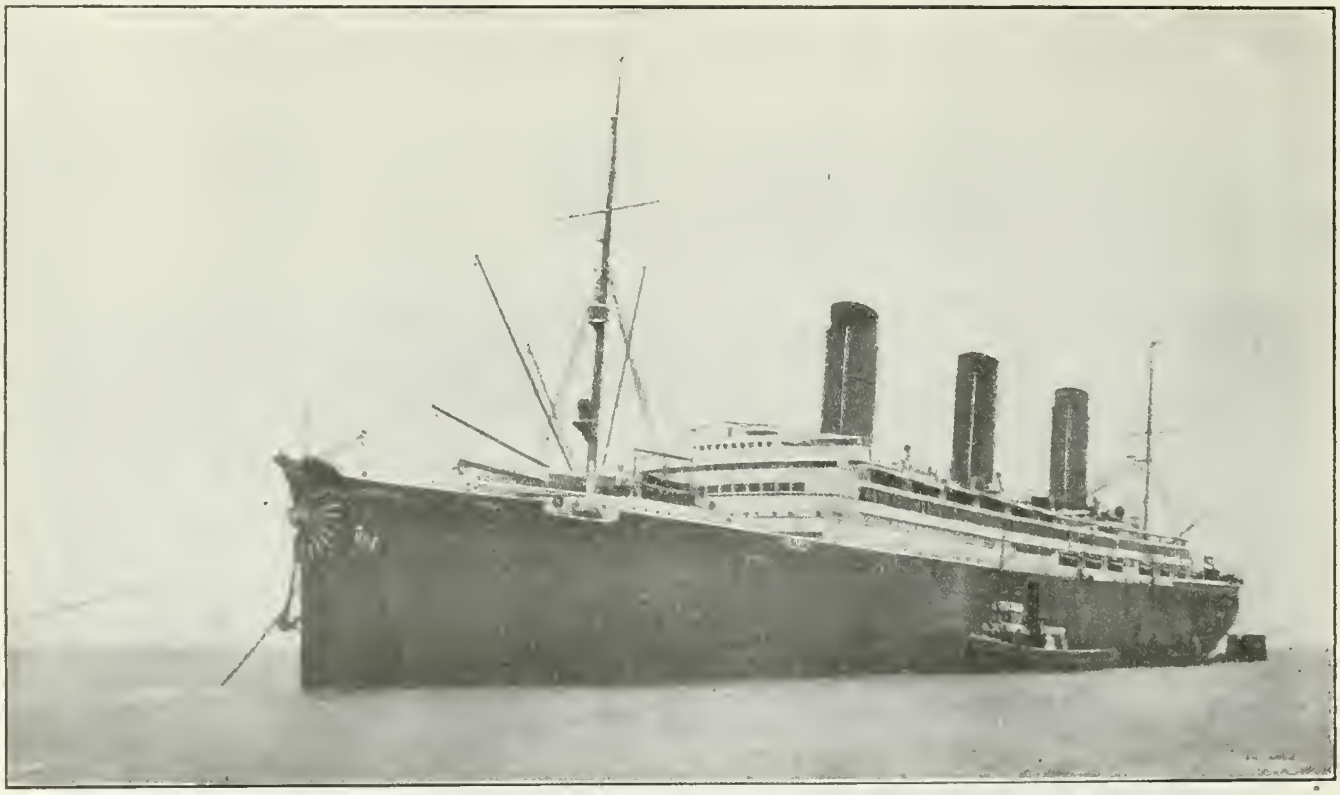
The amount of tonnage on the order books of the builders must have been very much larger a year ago than any single individual was aware of, as although there was a decided and prolonged reduction in the number of orders reported from time to time, there is, even yet, practically no reduction in the amount of tonnage actually on hand. Builders are still engaged in working off orders placed during the fag end of the boom, orders for first-class liners for companies whose requirements do not always depend on the general trade or the freight market, as that term is usually understood, and for warships for home and foreign navies.

Costs of production have, however, never been higher than they are now, and we need not doubt the words of shipbuilders in the least when they say that profits are far lower than they were when far less money was passing through their hands. Many of the Companies which depend on shipbuilding pure and simple paid very small dividends—some of them none at all—even when they had to their credit large records of new work, but those which combine steelmaking and armor plate manufacture with shipbuilding and engineering have made money, and their prosperity has been credited by the unthinking to shipbuilding because they are known best to the public as shipbuilders. This has been one of the misleading features of the industry for some years back.

The Engineering Shops.

In the engineering shops, the problems faced were less economic than mechanical. Marine engineering in particular is passing through a very obvious period of change, and the best authorities will not venture to predict the result. So far, the steam engine, in one form or another, has held its own against all competitors, and those who prophesied its gradual displacement by the internal combustion motor have seen reason to moderate their opinions. For most services, the modern reciprocating steam engine is more economical than the oil engine, so long as oil remains as expensive and as difficult to obtain at all ports as it is at present, while it has been proved that the turbine can be adapted by means of gearing to all services, and that, therefore, the oil engine must displace it, too, before it can be adopted anything like generally.

With oil fuel and geared turbines there seems to be still a great future for the steam engine; but engineering progress is so rapid nowadays that no one can tell whether it is to hold the field or be superseded by the direct-driving oil engine or the oil engine driving through electric, hydraulic, or other gearing. Marked progress is being made in all these directions, and in addition the combination of turbines and reciprocating engines is being used with the greatest success in the largest types of Atlantic liners. There has never been a more interesting period in the history of marine engineering than that through which it is now passing, or one of which it was more difficult to predict the ultimate development.

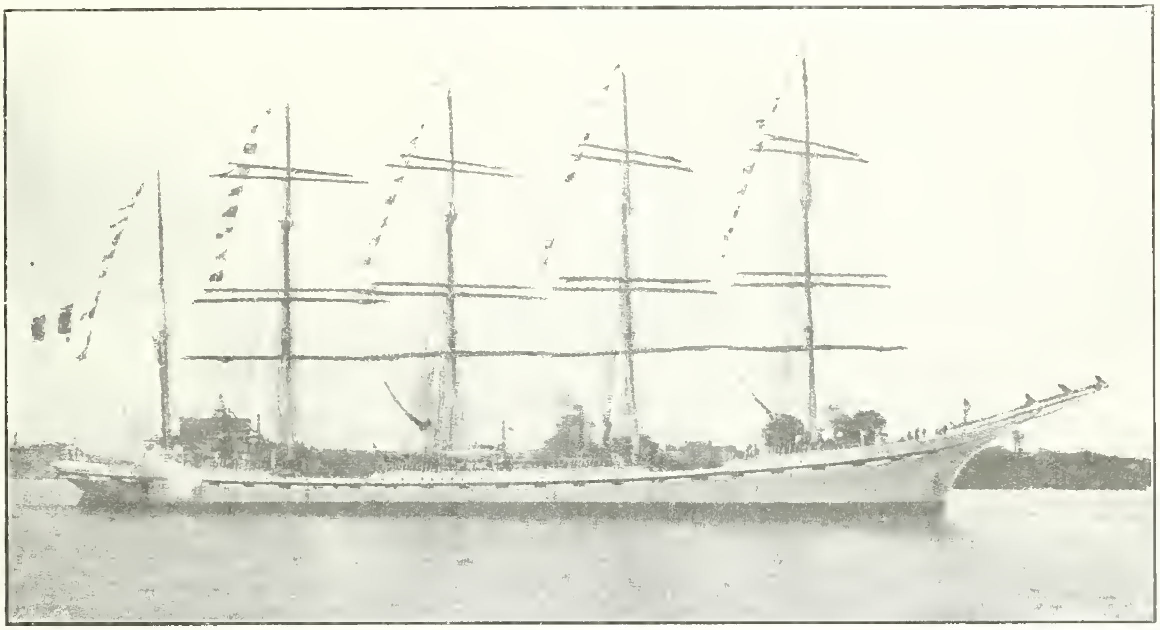


THE HAMBURG-AMERICA LINER "IMPERATOR."

Prospects.

Taken all over, the year may be regarded with satisfaction, but the prospects are far from being so bright as they were twelve months ago. The trade "boom," which has lasted for about three years, is showing marked evidence

of having spent itself, and, while it is impossible to prophesy, there is every prospect of a reaction. For some months manufacturers have experienced a falling off in the demand for their wares, the extent of which is best indicated by the reductions which have taken place in prices.



THE AUXILIARY SAILING SHIP "FRANCE."

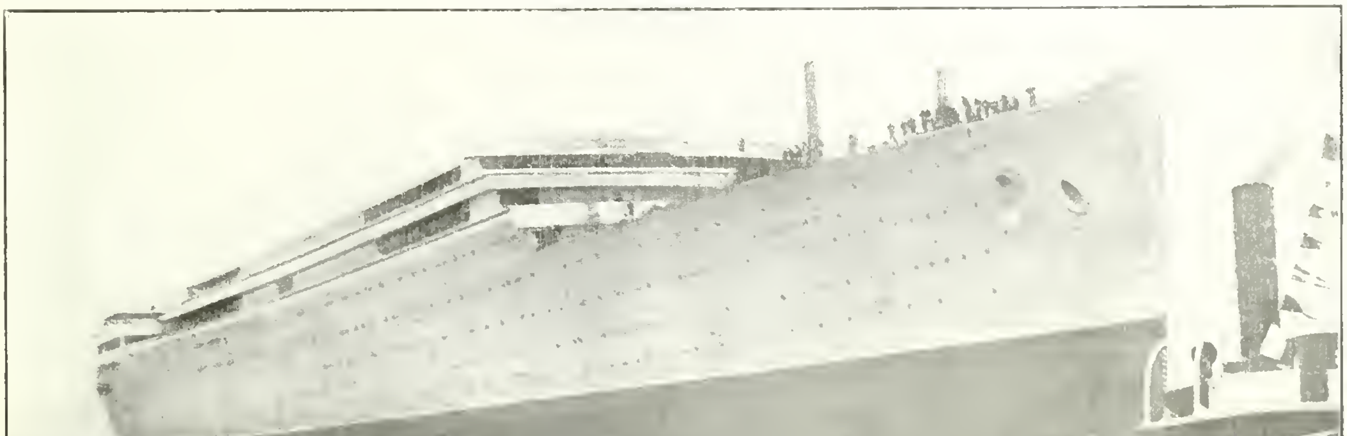
The change has been most marked in the steel and iron trades. Steel makers' books have become somewhat depleted, and notwithstanding the lower prices buyers are showing little disposition to book ahead. Pig iron makers also report a falling-off in trade, and many of the furnaces have been put out of blast, makers deeming a restriction of output necessary so long as costs remain so high and no apparent outlet for the iron. Shipbuilders, on the other hand, are well employed, and in some cases cannot undertake to give delivery of tramp tonnage before the autumn of 1914, and bridge builders and constructional works have well filled order books.

While it is true, however, that the trade outlook is not all that might be desired, the prospects for the coming year are not so doleful as they are reported to be in many quarters. Certainly new business is scarce, but in many branches of industry orders already placed will carry manufacturers well into the new year, while the lower level may bring out trade which in 1913 was retarded by the high prices which ruled.

Supremacy of British Shipbuilding.

If there is one lesson more than another which can be learned from the reports of shipbuilding work done in 1913 all over the world, it is that the leading position of Great Britain as a tonnage-producing country remains unchallenged, and—subordinate to this—that the Clyde remains easily the first and greatest of all shipbuilding and marine engineering districts. Despite all the progress which has been made in other lands, despite the obvious fact that other countries are now building as well and sometimes almost as expeditiously as Great Britain, and are endeavoring more and more to supply their own requirements, if not to do a little more, and despite too the admittedly harassing labor conditions which have to be faced in British yards, the country maintains its lead and its shipbuilders continue to provide about their old-time proportion of the total tonnage required for the world's trade.

In 1913 there was no retrogression. The vessels chronicled in the returns show a total in number of 3,936, and in



LAUNCH OF THE CUNARD LINER "AQUITANIA."

measurement of 4,267,166 tons, while there is recorded the remarkable total of 4,924,799 i.h.p. In all of these figures there are increases as compared with 1912—in number of vessels 325, in measurement nearly 500,000 tons, and in machinery over 677,000 i.h.p.

The figures for the United Kingdom make up a very large proportion of the totals, even granting that numbers of small "unmeasured" vessels were built abroad, especially in Holland, of which we have no account, and that our home returns are absolutely complete. In the United Kingdom there were launched 1,474 vessels of 2,263,933 tons, and there were manufactured marine engines of 2,661,260 i.h.p. These figures show increases over those of 1912 of 120 vessels, 183,762 tons and 388,994 i.h.p. Of these increases, the credit for the additional number of vessels is due wholly to England, and that for the increased tonnage and horse-power principally to Scotland. England produced 133 vessels, 95,071 tons and 135,460 i.h.p. more than in 1912, while Scotland produced 15 fewer vessels, but 121,523 tons and 233,485 i.h.p. more, while Ireland turned out 2 vessels more, 32,832 tons less and 20,050 i.h.p. more than in the previous year.

Comparing the work of the United Kingdom with that of other nations—leaving British Dominions out of the reckoning, as not being "foreign" countries—we find that the United Kingdom produced just about one-third of the total number of vessels, nearly 320,000 tons measurement more than all other countries combined, and nearly 420,000 horse-power more. The apparent discrepancy in the lower number of vessels is explained of course by the fact that the vessels built in the United Kingdom are of much greater average size than those built abroad, and even allowing for whatever foreign work may be unrecorded, the margin of tonnage and horse-power in favor of the United Kingdom is so large that the supremacy of British shipbuilding is unquestionable. The following table puts the shipbuilding work of the world for the years 1913 and 1912 in the shortest possible space:

	1913. Vessels.	1913. Tons.	1913. I.H.P.	1912. Vessels.	1912. Tons.	1912. I.H.P.
England	945	1,322,306	1,399,445	812	1,227,235	1,263,986
Scotland	505	809,711	1,148,225	520	688,188	914,740
Ireland	24	131,916	113,590	22	164,748	93,540
U.K. totals	1474	2,263,933,	2,661,260	1364	2,080,171	2,272,266
Dominions	280	59,025	20,662	208	36,578	17,922
Foreign	2182	1,944,158	2,242,877	2049	1,648,310	1,957,606
Grand totals	3936	4,267,116	4,924,799	3611	3,765,059	4,247,794

Leading Builders.

The old, old trouble about tonnage measurement renders it more than usually difficult to "place" the leading firms for 1913. On the strength of their "with erections" measurement of 107,636 tons, Messrs. Swan, Hunter and Wigham Richardson would be an easy first, but when the work of all the firms is reckoned by Board of Trade tonnages for merchant ships and displacement for warships, it is found that the highest total for the year is to the credit of another Tyne firm—Armstrong, Whitworth & Co. It is all a question of methods of measurement of course, and the Elswick concern have the highest total, principally because they launched two battleships, the tonnage of which is displacement, while the big yards at Wallsend and Walker have the displacement of only two destroyers, and the measurement of one caisson, apart from their Board of Trade tonnage. On the basis of official measurements, then, the order of the first half dozen firms in the matter of tonnage is as follows:—

	Vessels.	Tons.
Armstrong, Whitworth & Co.	9	99,333
Swan, Hunter & Wigham Richardson	22	97,335
Blohm & Voss	8	96,850
William Gray & Co.	18	85,298
The Vulcan Co.	14	85,213
Workman, Clark & Co.	11	84,217

The following are the firms which have had the largest tonnages in the world since 1900:—

Year.	Company.	Tons.
1913	Armstrong, Whitworth & Co.	99,333
1912	Swan, Hunter & Wigham Richardson	121,281
1911	Harland & Wolff	118,203
1910	Harland & Wolff	115,861
1909	Workman, Clark & Co.	88,952
1908	Harland & Wolff	106,528
1907	American Co. (7 yards)	191,602
1907	William Doxford & Sons	91,254
1906	American Co. (6 yards)	193,535
1906	Swan, Hunter & Wigham Richardson	117,943
1905	American Co. (7 yards)	136,793
1905	William Doxford & Sons	86,632
1904	Russell & Co.	73,689
1903	American Co. (7 yards)	166,288
1903	Harland & Wolff	110,463
1902	American Co. (7 yards)	132,197
1902	Harland & Wolff	79,497
1901	Harland & Wolff	92,310
1900	William Gray & Co.	74,191

The "vessels of the year" were undoubtedly the huge Hamburg-Amerika liner Vaterland, built at Hamburg, and the almost equally huge Cunard liner Aquitania, built at Clydebank. The Vaterland is of 56,000 tons, and is a few thousand tons larger than her sister ship The Imperator, so that she is the largest vessel in the world. The Aquitania—of 47,000 tons—is the largest owned in Great Britain, and the next largest in the world after the two German boats. After the Aquitania there comes the 35,000-ton Norddeutscher Lloyd liner Columbus, built at Danzig, and after this vessel the Hamburg-Amerika liner Tirpitz, of 21,000 tons, built at Stettin. The Clyde-built Allan liners Alsatian and Calgarian—each of 18,500 tons—make the fifth item in the group, and the Hamburg-Amerika liner Cap Trafalgar, of 18,000 tons, built at Hamburg, completes the half dozen—seven vessels really of course. It may be added that although the Vulcan Company have themselves returned the Cap Trafalgar as of 18,000 tons, she has since then been officially referred to as of 18,700 tons, so that it is possible that she should be reckoned as larger than the twin Allan liners. In that case four of the largest half dozen vessels launched in 1913 will have been German built.

Vessel and Type.	Builders.	Tons.
Vaterland—4 screw turbine	Blohm & Voss	56,000
Aquitania—4 screw turbine	John Brown & Co.	47,000
Columbus—twin screw	F. Schichau	35,000
Tirpitz—twin screw turbine	The Vulcan Co.	21,000
Alsatian—4 screw turbine	Wm. Beardmore & Co.	18,500
Calgarian—4 screw turbine	The Fairfield Co.	18,500
Cap Trafalgar—3 screw, recipro. and turbine	The Vulcan Co.	18,000

Leading Engineers.

A very large proportion of the total of 1,111,440 i.h.p. produced by Clyde engineers came from the works of two firms—John Brown & Co., of Clydebank, and the Fairfield Shipbuilding & Engineering Co., of Glasgow. Together, these firms manufactured marine engines —mostly turbines—of 451,200 i.h.p.—more than a third of that of the whole river. The Clydebank work makes a total not only the highest in the world this year but the highest ever produced by one firm, and it, like that of the Fairfield Co., and that of Schichau, of Danzig and Elbing, represents very largely machinery for war vessels. In 1912 John Brown & Co., had the highest horsepower in the world, and the Danzig firm the second highest. The following is the order of the first half dozen engineering Companies:—

	I.H.P.
John Brown & Co.	239,000
F. Schichau	212,800
The Fairfield Co.	202,300
Blohm & Voss	161,000
The Wallsend Slipway Co.	159,550
The Danubius Co.	152,000

R. Garrett, of Montreal, general manager of the International Engineering Co., Amherst, has returned from Liverpool, England, where he has been spending a holiday at his home.

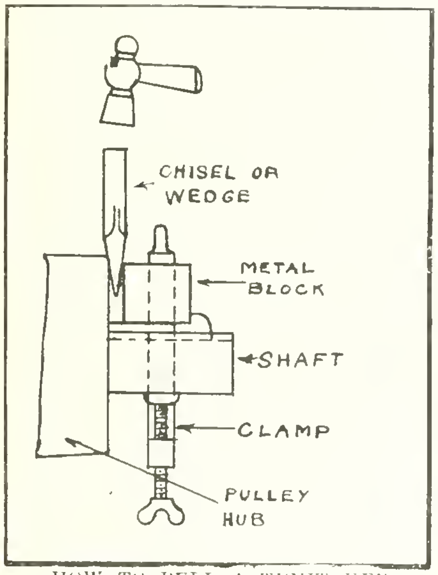
MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

HOW TO PULL A TIGHT KEY.

By N. G. Near.

THERE is shown herewith a little scheme that I have found useful for pulling tight keys. The drawing makes the operation self-evident. The metal block is thicker than necessary in order to show the method more clearly. It is, in fact, better to use a thinner block thus making the overturning movement less. Of course the exact arrangement illustrated need not always be strictly followed, there being a hundred and one variations based on the same principle.



HOW TO PULL A TIGHT KEY

PLANING UP GAS ENGINE CAMS.

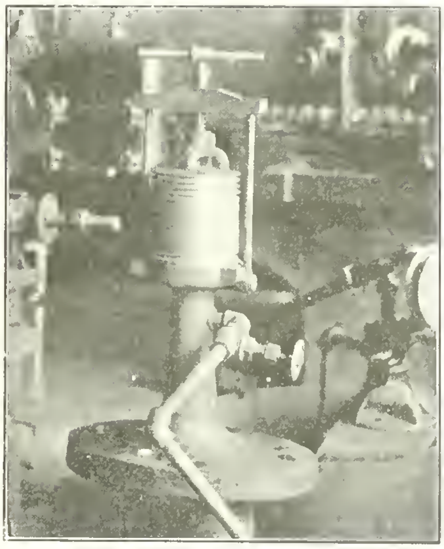
By A. E. Granville.

A GAS engine shop in Elyria, Ohio, planes up their cams as shown in the accompanying cut. The cams are first bored out and keyseated, after which they are clamped on a keyed mandrel. This mandrel is then placed between centres on a planer. The first cam on the mandrel is a hardened master cam, and the operator manipulates his tool so as to cut the others according to the outline of the master cam, as he turns the mandrel by means of the worm and worm gear at the right. Very satisfactory results are obtained in this way on large cams, without the expense of a special machine.

TESTING PISTONS.

By A. E. G.

A METHOD of testing automobile pistons, in use in the Royal Tourist factory, is here shown. The piston is placed on the stand, open end down, the yoke is swung up over it, and the screw clamp tightened. Next, water under high pressure is turned into the inside of the piston from the pipe in the foreground. In this way, any leaks that might develop through flaws in the casting may be easily detected by the water oozing through to the outside.

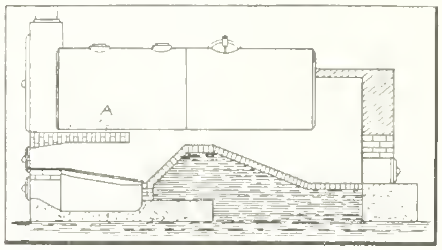


TESTING PISTONS UNDER WATER PRESSURE.

PROTECTIVE ARCH.

By C. Fenwick.

THE accompanying drawing shows an improved setting for return tubular boilers. The arch over the fire serves the double purpose of improving combustion and preventing the burning of the boiler. In nearly every case, mud and loose scale will lodge as shown at (A) in the drawing, and where very dirty water is used the arch will be a great help.

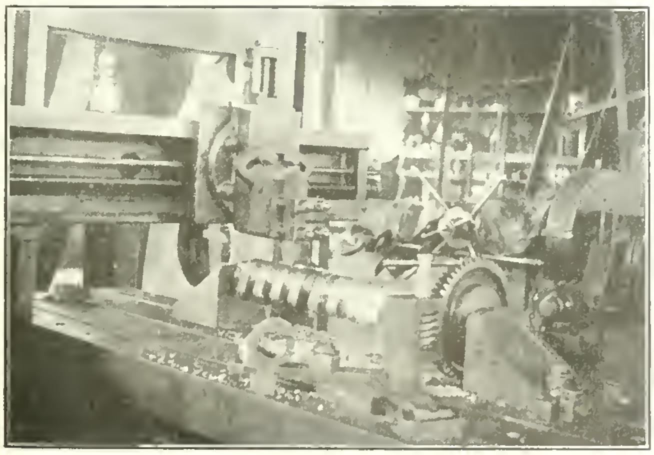


PROTECTIVE ARCH.

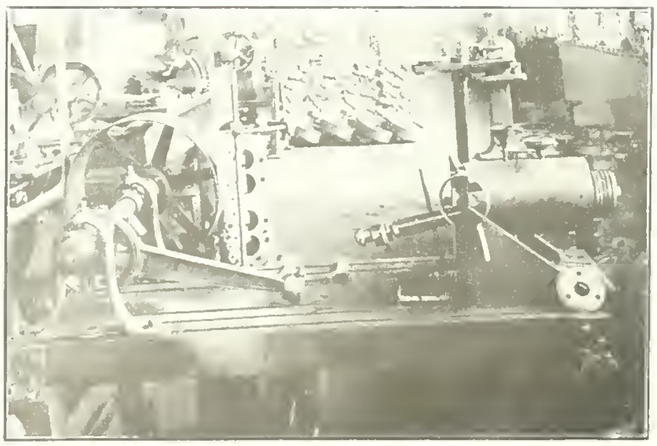
GRINDING-IN PISTON RINGS.

By A. E. G.

AN unusual method of grinding-in piston rings, after they are split, in order to make them perfectly round, is practised in the Nordyke & Marmon shop. The piston rings are placed on a special piston and run in a cast iron cylinder as shown in the illustration. The piston is operated by a belt-driven



PLANING-UP GAS ENGINE CAMS



GRINDING-IN PISTON RINGS.

eccentric, the rod of which is connected to the piston rod by a ball and socket joint, so that the piston may be revolved during the lapping operation. Powdered glass and oil are poured into the cylinder through a small funnel in the top. The rings come from this operation with a beautiful finish, and so round that they fit the automobile cylinders perfectly. The reason for using powdered glass is that it does not imbed in the iron as does emery.

A NEGLECTED SAFETY DEVICE.

By J. H. W.

IN spite of all that employers may do towards instilling the "Safety First" idea into the minds of their employees, and in spite of all the safety appliances with which they may equip their machinery, men will still be found who seem to take a pleasure in tempting Fate. The accompanying illustrations show how a serious accident occurred in the planing mill at the Turcot works of the Canada Car and Foundry Co. An employee, while operating a tenoning or gaining machine, held the piece of lumber on which he was working with his hand, instead of using the presser bar and post attached to the machine for the express purpose of preventing accidents. After gaining the piece, he pushed the material over to the coping head, with the result that the latter pulled the piece of lumber from the operator's hands, and at the same time forced the gauge out of position. The consequence was that the man's left hand was drawn under the gaining head, resulting in the partial severance of four fingers.

This accident was caused entirely by the gross neglect of the victim, who failed to use the safety appliances provided.

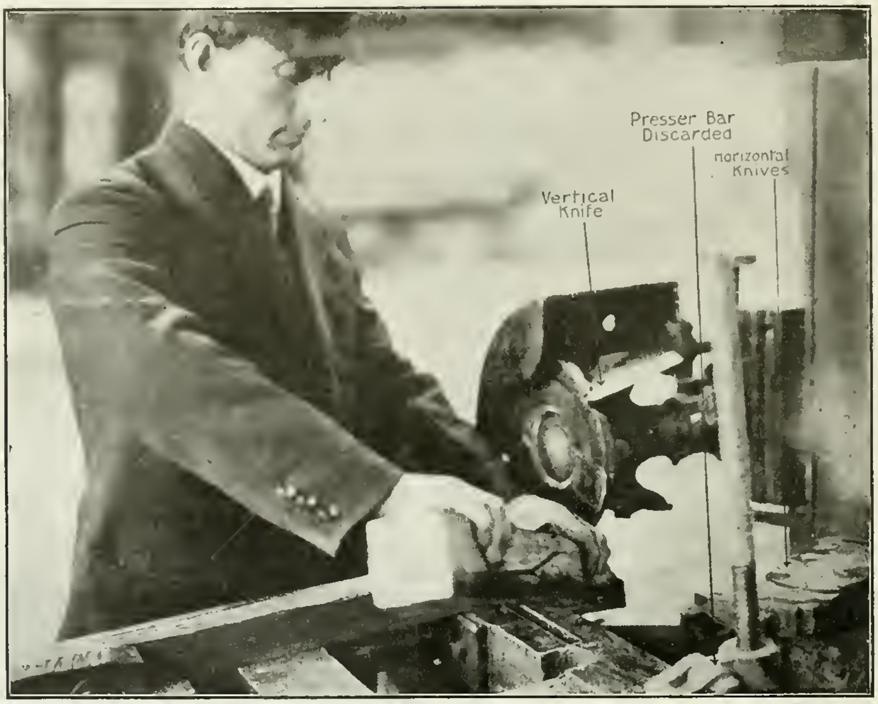


FIG. 2. A NEGLECTED SAFETY DEVICE.

Fig 1 shows how the operation should be performed. The operator's hands are seen to be entirely out of danger while he pushes forward the table on which the lumber is held down by the presser bar. How the accident happened is clearly shown by Fig. 2. The operator is here seen gripping the piece of wood with both hands instead of using the presser bar. The horizontal knives have thrown the work back on the vertical knife, and the operator's left hand is being drawn under. The presser bar is lying idle at the back of the table, and the front vertical post has been removed.

These illustrations are published by courtesy of the Canadian Car and Foundry Co., Ltd.

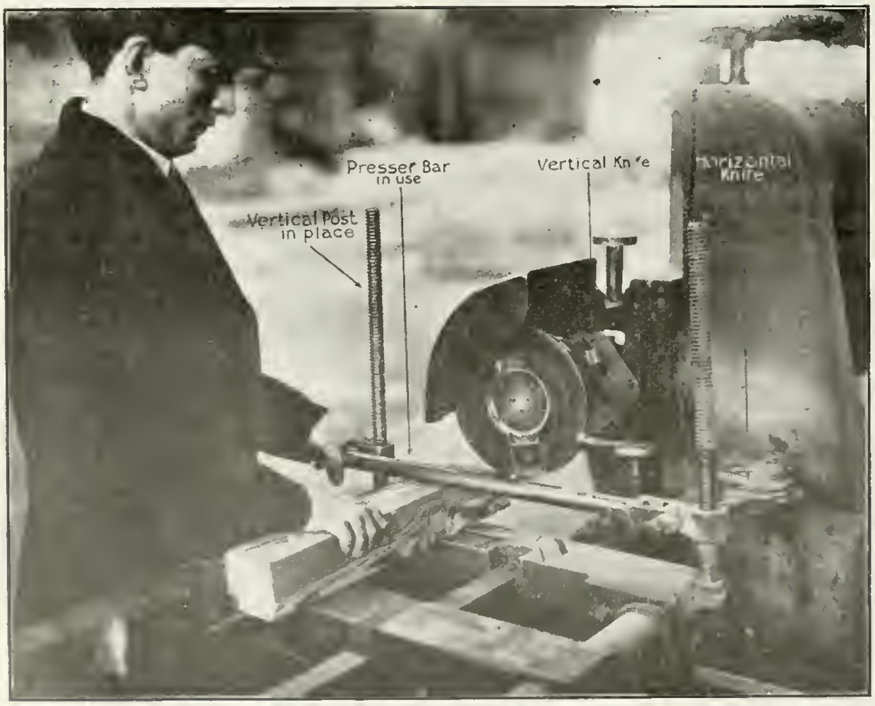


FIG. 1. A NEGLECTED SAFETY DEVICE.

BLUING IRON AND STEEL PRODUCTS.

By A. V. Francis.

WHILE the subject of bluing iron and steel products is an old one, there are probably many mechanics who envy the necessary knowledge of details to ensure such excellent bluing jobs as those commonly found on revolver and gun barrels. The following method is in vogue in most of the gun shops, and may be of interest to those not already familiar with the details of the process:

The apparatus required consists of a rectangular cast iron tank of suitable dimensions. This is made round at all corners to diminish the liability of its cracking by expansion or contraction, and is permanently set over a furnace. The tanks in use are usually of sufficient size to hold 20 pounds of black oxide of manganese, with 180 pounds of potassium (200 pounds of the mixture in the proportion of 1 to 9). The fire being built in the furnace underneath the tank, the saltpetre melts and the manganese settles on the bottom like thick mud. When the workman is ready to com-

mence operations, he stirs up the manganese, and then ascertains whether the bath is of the right temperature by throwing upon it a sprinkling of dry sawdust. If conditions are right, the sawdust will instantly sparkle and ignite, but if the bath is not quite hot enough, the sawdust will glow for some time before taking fire.

Having brought the bath to the proper temperature, the work, which must be absolutely dry, is immersed in it and allowed to remain until heated to the same degree. If tempered work, it is plunged as soon as taken from the heated bath for a few seconds into cold water to set the temper. If the work be not tempered this plunge is omitted. It is then dipped into boiling hot water for a moment, and then immersed in a bath of oil. When removed from the oil, it is allowed to drain, being subsequently wiped off. It will then be found to be of a beautiful dark blue color, of a depth and permanence greater than that obtainable by most other known methods. Either iron or steel can be blued in this way. Great caution must, however, be exercised to prevent the nitre from coming in contact with the fire on account of its expansive and explosive nature. The tanks are replaced as soon as any signs of cracking appear.

In order to produce the best results, it is necessary that the surface shall be made thoroughly clean, for if a piece of highly-polished steel is simply touched with the uncovered hand, there will be an impression left upon it which will show after it is blued unless the imperceptible stain is removed before the heat is applied.

Variety Coloring.

A variety of colors on iron and steel can be produced by means of a mixture of lead acetate and sodium thiosulphate. The following proportions may be used, with the results enumerated below, the colors altering with the time of immersion:—Lead acetate, 50 grains; sodium thiosulphate, 50 grains; water, 5 fluid ounces. The solution must be used hot.

1. Light brown color; 2, darker brown color; 3, purple and blue mixed; 4, purple and blue paler tone; 5, uniform bright blue color; 6, steel grey; 7, black color after a half-hour immersion.

Another way is to dissolve in four parts of water, two parts crystallized chloride of antimony, and one part gallic acid, and apply the solution with a sponge or cloth to the article. Repeat any number of times until the desired depth of color is obtained. Wash with water, then dry, and finally rub articles over with linseed oil. The metal thus receives a brown tint and resists moisture.

IMPROVED RAIL-JOINT.

SEVERAL steamshovels in the service of the Panama Canal Commission are operating on portable tracks equipped with a rail-joint designed and patented by P. J. Thull, of Culebra, a steamshovel engineer now employed by the Fortifications Division. The joints are manufactured in the shops of the Mechanical Division, and are made of cast steel.

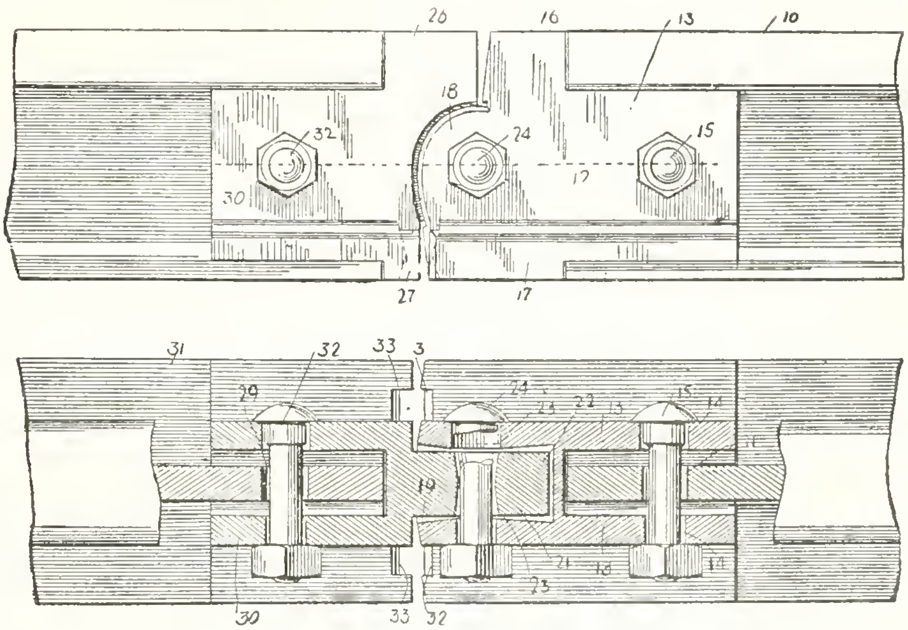
Steamshovel operations require usually that the shovel advance in the progress of excavation over uneven ground of varying firmness. Six-foot lengths of track handled by laborers in the shovel pit are connected ahead of the forward trucks of the machine. Conditions frequently require that these lengths of track deflect in both vertical and lateral planes with the passage of the machine. The ordinary strap joints, using plates 1 inch thick, $2\frac{1}{2}$ inches wide, and 10 inches long, with two 1-16-inch holes punched at either end, provide for slight variation. If connected loosely enough to allow lateral turning, they make the track insecure, and vertical motion is restricted by the flanges of the rails. The provision of curved sections to meet contingencies is inconvenient and expensive. The Thull joint is designed to be used on both horizontal and vertical curvatures, and to provide means for eliminating the horizontal displacement while keeping the vertical displacement.

Referring to the illustration, (10) represents a rail, provided near the extremity with elongated apertures (11), and engaging the end of the rail with its side flanges or cheeks (13) is the female part (12) of the joint. The cheeks are abutting against the top and bottom of the rail and are provided with an aperture (14), registering with the aperture (11) of the rail (10), so that bolt (15) binds the cheeks (13) of the female part of the joint to the rail end, forcing the upper and lower abutments of the cheeks against the head and bottom of the rail flange.

A portion (16) of the female part is offset so as to conform with the head of the rail, abutting against the same and having the same width, and flush at its sides with the cheeks (13). A portion (17) is also offset in a direction opposite to the offset (16), being made to conform with the bottom flange of the rail, abutting against it, and having the same width, and made flush with the lowermost surface.

At the ends opposite the cheeks (13) and substantially central with them, jaws (18) are provided, forming the female portion of the joint, with a recess (19) formed in the body of the female part, and complementing the jaws (18). The jaws (18) have their end surfaces beveled, and the end surfaces of the projections (16) and (17) are similarly beveled. Engaging the female portion (12) by means of a tongue (21) substantially circular in shape is the male part. The tongue fits loosely into the recess (19) of the member (12), and is provided with a projection (22) fitting into the recess (20), with sufficient play at top and bottom.

Orifices (23) and (23'), substantially central with the jaws (18) and central member (21), are provided in both the male and female portions, and a bolt (24) binding these two portions constitutes a centre or pivot for same. The male part is also provided with flanges (30), offset portions (26) and (27) similar to (16) and (17), respectively.



SIDE ELEVATION AND HORIZONTAL SECTION OF THULL RAIL JOINT

abutting against the head and flange of the rail, and also with orifices registering with orifices (29) in another rail (31). The male part is similarly attached to the rail (31) by means of a bolt (32), as is the case with the female part above described.

The recess (19) formed in the female portion (12) is beveled, so as to converge toward the middle of the sides. The orifice (23') is also beveled from the centre toward the extremities, so that the male portion can be translated horizontally to right or left, according to extent of the bevel provided in the recess (19), and, as above described, the offsets (16) and (17) have their end surfaces beveled for the purpose of allowing the horizontal displacement. By means of this provision in the joint for the horizontal displacement, a curvature can be formed in the joint of a certain degree, and the track may have any zigzag shape desired within the limits of the bevel provided in the joint—that is, in the recess (19) and orifice (23').

The vertical displacement, as can be seen, is obtained by the rotation of the joined parts about the centre, which is the bolt (24), and this displacement is limited in the vertical direction, up and down, by the portion (22) of the male part engaging the recess (20), as above described. When only vertical displacement is desired, and the horizontal is to be prevented, notches (32) and (33) are provided at each side of the facing ends of the bottom of the male and female parts, these notches being beveled from the centre upward and downward, so that a spike may be inserted, preventing side displacement, but allowing rotation about a pivot, there being bevels provided where the spike engages the female and male portions.

With this device, any safe unevenness in the ground should be taken up by the vertical displacement of the joint—that is, by the pivotal connection. Similarly, there should be no necessity for a series of curves, as the safe curvature for a rail will be formed by the articulated joint in the horizontal plane.

A trial set of these joints was manufactured at Gorgona shops, at Mr. Thull's expense, for use on the shovel which he was operating, and upon their appearing satisfactory, the Canal Commission ordered the manufacture of enough to equip ten steamshovels. Each shovel requires twenty-two joints. Under a contract, dated July 28, 1913, the Commission pays Mr. Thull a royalty of 70 cents on each joint manufactured; and in a letter, dated December 30, 1913, the superintendent of construction of the Fourth Division reported to the resident engineer in charge of the division, with reference to the Thull joint, as follows:

"These joints have been in use for several months and are still giving satisfaction. They are much better than the ordinary strap connection under all conditions, but are especially so in cases where shovels are working on a soft bottom or where there is considerable water in the shovel pit. The sections when connected with these joints have almost a continuous rail. The old strap connections make such a loose joint that the wheels of the trucks would often climb the rail when moving up, unless great care was taken. This happened where the sections were down in the mud or covered with water. The Thull joints are also valuable when shovels are working in slides, where it is often necessary to back them out of the pit very suddenly, without sufficient time being available to line the sections up in proper shape."

DRAWINGS FOR PATTERN-MAKERS.

In many works where short time deliveries of orders are given, said Mr. Thomas Roberts in his recent paper read before the Manchester Association of Engineers, the system prevails of sending to the pattern shop preliminary or temporary plans, so that the pattern-makers can start the order and save time while the plans are being finished. This means that when you think the pattern is almost finished, and the corrected plan comes to hand, you find out you have only just started, for the so-called small alterations of the drawing office turn out to be large and annoying. The alterations make the pattern a very expensive one, and the time supposed to be saved is sometimes more than lost in making alterations, while, in many cases when the pattern is completed, it gives no satisfaction either to the workman, his foreman, or the moulder who has to work off it.

If good cheap patterns are to be made, and that is what all engineering works are asking for, the best way to achieve this object is to give the worker a good clear drawing, with all elevations, plans, and sections of complicated parts shown, so that any ordinary pattern-maker can read them All tooled parts should be shown by the letter (T) or red-lined, and all internal cores with metal round them ought to have shown on the plan the arrangement for getting out the cores and allowing for the escape of the gases. This might be arranged with the foreman moulder while the drawings are in progress. It very often happens that when this is left to the discretion of the foremen concerned, they will put them, to suit themselves, in a place which is wrong, and then there is trouble in the erecting-shop.

Alterations to Drawings.

Another important point is the alteration of figures on blue prints and standard plans when wanted for new orders. These ought to be made in white or black, not red ink, which has been the cause of a great many pattern-makers' troubles. In all works where they have any respect for standard drawings, the paper tracings and prints are mounted on cloth where intended for shop use. This is a good plan and ought to be generally adopted.

In nearly all factories, old plans and drawings have to be altered to suit new orders, and these alterations ought to have a mark or notification on a special list issued to the shop of parts altered; this prevents alterations being missed, and ensures proper checking of the pattern before sending to the foundry. Those who have to deal with these altered plans will understand the importance of this suggestion.

The chief draughtsman or the draughtsman who has made the drawings of any special work might pay a visit to the pattern room when patterns are finished, and inspect them. The time spent in doing so will not be lost in a great number of instances. In the case of large patterns, the writer has insisted on this being done, and all concerned have felt the benefit of it.

Another point which should not be left to the shop is that where there are unequal thicknesses in parts of castings, the working from thick parts to thin parts by large hollows, brackets, or root corners ought to be shown on plans and carefully thought out. By doing this the drawing office might help the foundry, and save them from having cracks and breakages in the castings caused through unequal contractions. All alterations made on plans whilst the work is in progress should be notified to the foreman concerned, so that care could be taken that none of them are missed.

The writer's opinion formed after an experience of thirty-four years as a foreman pattern-maker in a large works is that if possible a complete set of finished drawings should be sent into the shops with the order for the work to be done. The job would be then done quicker and cheaper than is possible when the drawings are sent in as they are separately finished. There would be less friction between departments, less need for casting hustlers, and less complaints about the time taken up in each department. In orders wanted for quick delivery, the time for each department could be clearly allotted and worked to.

W. K. Stalford has been appointed electrical inspector for Hamilton, at a salary of $1,300.

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

THE LARGEST HARBOR CRANES IN THE WORLD.

By C. F. Krumbiegel*

THE immense increase in size that has taken place in war and merchant vessels during the last twenty years has naturally resulted in a corresponding development in shipyard and harbor facilities. It has been found necessary to improve and enlarge harbor equipment that it might be commensurate with the giant dimensions of the latest vessels; and last, but not least, it has been found necessary to provide the most modern and efficient cranes in order to facilitate the building of such vessels and to enable a large tonnage to be handled quickly and with as little labor as possible.

As a proof that engineering science and capital have been fully able to keep pace with modern requirements, a description is here given of two giant cranes, one a land crane and the other of the floating type. These may be considered the latest word in crane building and have been designed and built by the Deutsche Machinenfabrik, A.G., (Demag), Duisburg, Germany.

The Largest Land Crane.

Figures 1 and 2 show the largest land crane in existence to-day. It is a hammer-head crane of 250 tons capacity and was built for Blohm & Voss, Hamburg, in 1913. It is a revolving crane with a working circle of 500 feet diameter, and has a raising jib designed to clear the masts of ships very much larger than the greatest now afloat. In its highest position, the top of the jib is 327 feet above ground level. On the top chord of both jibs there runs a slewing crane with a capacity of 20 tons at 33 feet radius, or 10 tons at 58 feet radius.

The main trolley, which runs within the main jib, is able to lift 250 tons at a radius of 97 feet or 110 tons at 174 feet radius. The lifting speeds are as follows:—

Load.	Speed.
250 tons...about	5 feet per minute.
200 tons...about	6.4 feet per minute.
100 tons...about	13 feet per minute.

The trolley speed with a load of 250 tons is 32 feet per minute, and the jib can revolve through a complete circle in 12 minutes. When the jib is to be raised, the slewing crane is brought to the rear end, and the main trolley is fixed at the point of the jib, these operations only occupying a few minutes. The crane can then be loaded as before.

To give an idea of the enormous dimensions of some of the parts, it may be mentioned that the spindles for raising the jib have a diameter of 18 inches and a length of 69 feet, while the bottom block of the 250-ton hook has a length of 15 feet. The entire drive is electric, the output of all the motors totalling 524 H.P. The operation of the crane, with all its lifting and slewing motions, requires only three men.

*Resident Engineer, Gerald Lomer, Ltd., Montreal, Canadian Sales Agents for Demag Ltd.

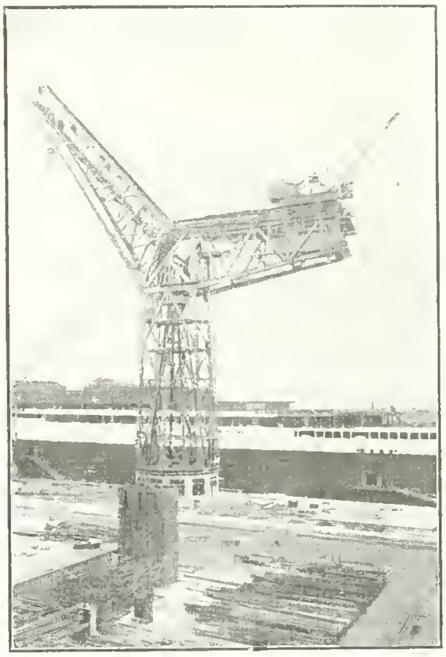


FIG. 2—250-TON HAMMER-HEAD CRANE WITH JIB RAISED

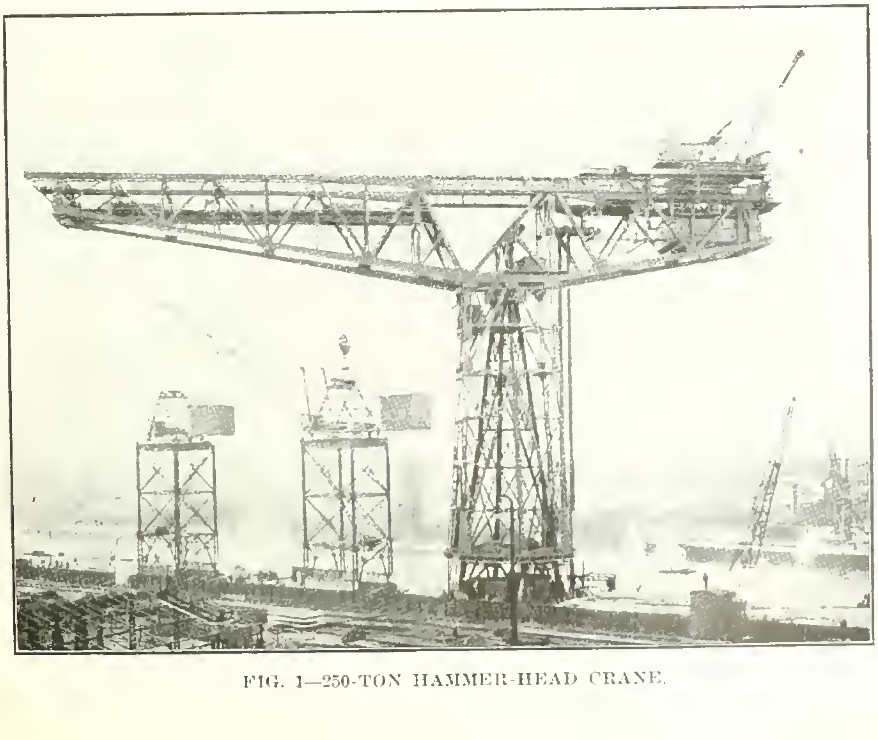


FIG. 1—250-TON HAMMER-HEAD CRANE.

The Largest Floating Crane.

As an example of the largest cranes of the floating type, there may be cited the two 250-ton cranes for the Panama Canal, ordered in April, 1913, by the United States Government, and at present under construction in the Demag Works. Each of these cranes will have a raising boom with a working circle of about 240 feet diameter, and their height will be equal to that of an 18-storey building.

The pontoon, which is entirely of steel plate, has a length of 145 feet, a width of 88 feet and a depth of 16 feet, and is well balanced at every position of the load. The four columns of the tower reach through the deck down to the bottom of the pontoon to ensure a very rigid connection of both parts. About three feet above the pontoon deck, and rigidly riveted to the tower, is the supporting ring for the rollers, which are carried by the so-called bell. This bell is supported on the king journal of the main tower by means of a heavy box lattice girder, the lower edge of which is level with the boom hinges.

In the forward part of the bell is placed the operators' house, which contains all the apparatus for controlling the crane. There are two main hooks of 125 tons capacity each, which can be connected by a 250-ton loop. Besides this, a climbing hoist of 15 tons capacity is provided for lighter loads. For lifting the heavy sluice gates of the canal, both cranes may be worked together, giving a total capacity of 500 tons.

These cranes are not yet completed, but Fig. 3 shows the type. This illustration has been taken from a somewhat smaller crane, which is shown moving a slewing crane into another position. The large crane in this illustration was supplied to Friedrich Krupp's Germania shipyards at Kiel. It is worthy of note that Demag have built more than 50 per cent. of all existing giant cranes.

As Canadian ports are now being developed to meet the ever increasing traffic requirements, it is hoped that the above description may be of interest to engineers and others. This country is in the fortunate position of being able to equip her harbors from the start with the most up-to-date loading devices, in place of having to make the best of old-fashioned equipment installed many years ago, as older countries may sometimes have to do.

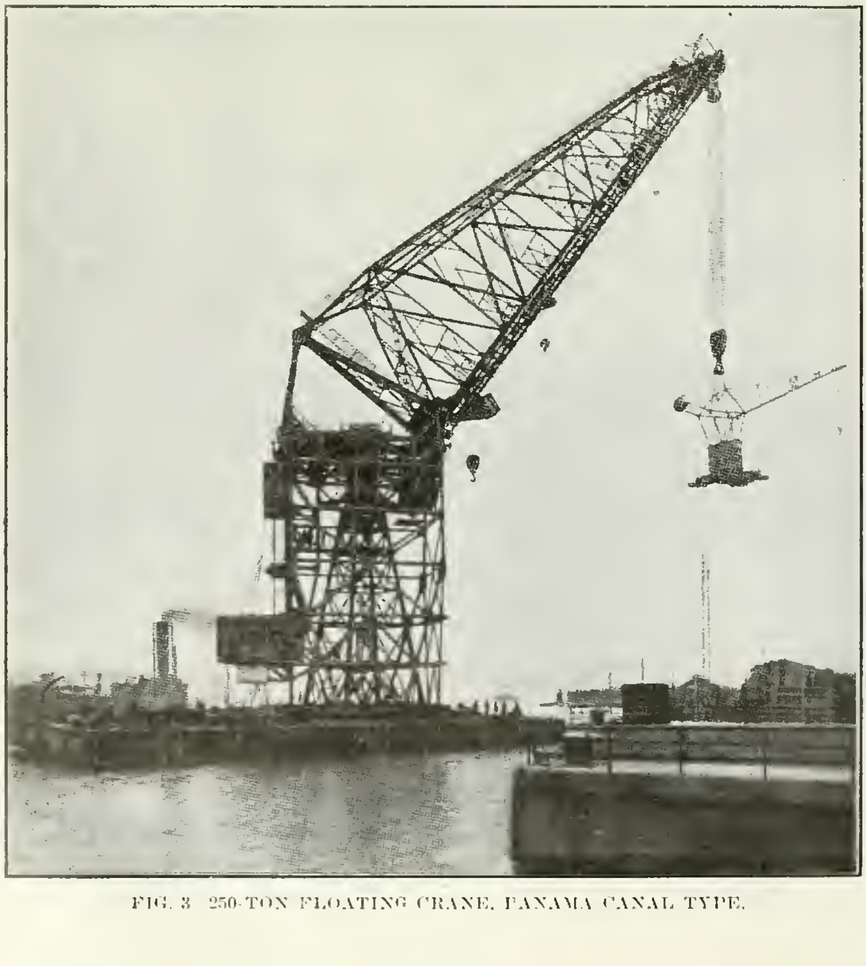


FIG. 3 250-TON FLOATING CRANE, PANAMA CANAL TYPE.

A "BENNIS" COKING STOKER INSTALLATION.

THE accompanying description and illustrations refer to an installation of what is known as the "Bennis" high temperature, smokeless and gritless machine coking stoker at the London Paper Mills, Dartford, England. Coal is transported by means of Bennis U-link chain conveyors, feeding distributing shoots through openings in the bunkers. The plant consists of:

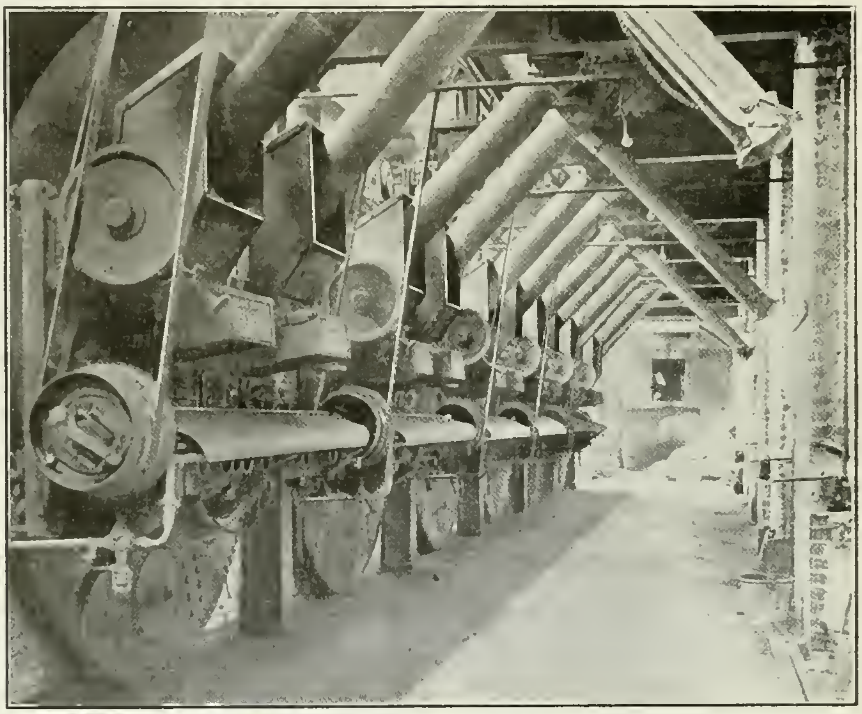


Fig. 1—A range of "Bennis" High Temperature Machine Coking Stokers keeping steam in the Boiler-house of the London Paper Mills.

1.—A receiving hopper with supports placed outside the boiler-house on the bank of the river, in such a position that the coal can be deposited into the hopper by a crane and grab.

2.—An overhead coal storage bunker having a capacity of about 330 tons of coal.

3.—Bennis U-link chain conveyors with driving gear, shoots and all supports.

4.—Shoots to carry the fuel from the bunkers to the hoppers of the stokers by which the boilers are fired.

The method of operating the plant is as follows:—The coal is brought up to the wharf in barges. A grab load of coal is raised from the barge by the crane, and dumped into the receiving hopper from which it flows through an outlet into the chain conveyor, which is placed immediately beneath. The first portion of this chain conveyor is carried up an incline and the coal is thus raised to the level of the top of the bunkers. The conveyor then passes horizontally over the top of the bunkers, and the coal is dropped through openings into the storage bunkers beneath. The coal flows by gravity from the storage bunkers into the storage hopper, and a valve is placed at the end of each shoot to control the supply of coal.

The conveyor is of the well-known

Bennis U-link chain type of which this firm has made a specialty during the last twenty years. It has a capacity of 40 tons per hour, and is driven through suitable reduction gear by a separate motor. The overhead coal storage bunkers are built over the firing floor; they are about 80 ft. long by 11 ft. wide, and have a total capacity of about 330 tons. The boiler-house wall is utilized for one side of the bunkers, while the other side consists of a reinforced brickwork wall. The bottoms of the bunkers are hoppered in shape, and are formed out of rolled steel plates with suitable stiffeners and connections.

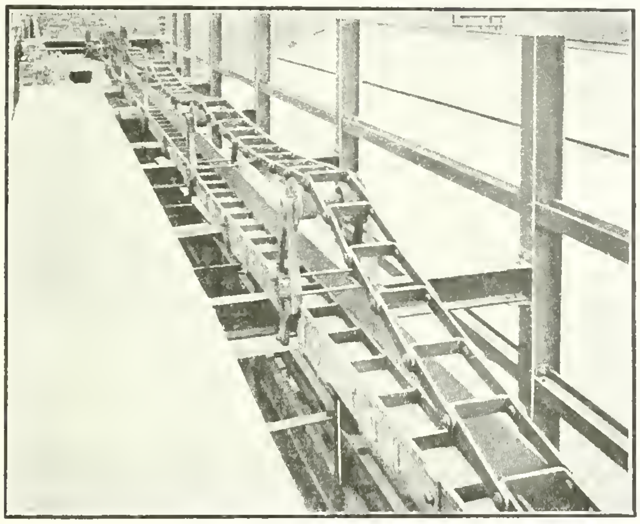


Fig. 2—"Bennis" U-link Chain Conveyor which in part of its travel is inclined to carry the coal to the level of the top of the bunkers. It deposits the contents by means of openings into the storage bunkers beneath, and forms part of the "Bennis" installation of coal handling plant in the boiler-house of the London Paper Mills.

A number of rolled steel joists run the whole length of the bunker to form supports and carry the weight between the stanchions. These longitudinal joists are supported in their turn by other transverse joists spanning the firing floor and carried at one end on substantial stanchions, resting on the floor; the other end being built into the wall of the boiler-house. These stanchions are also used for supporting one side of the main boiler-house roof, and a light roof is built over the top of the bunkers themselves. Access is given to the conveyor chamber over the bunkers by ladders and gangways, arranged so that all running parts are easy of access for inspection and lubrication. The bunker was designed to take full advantage of the existing buildings and to give the required storage without forming any obstruction to the movements of the boiler attendant. It is so arranged that future extensions can be easily affected.

The work of the U-link chain conveyors, as already stated, is to feed the coal to the bunkers which deliver it by means of openings into the distributing shoots which in turn deposit it in the stokers. The illustration, Fig. 1, affords a good view of this range of stokers with the shoots in position and in close connection with the bunkers immediately above.

It is of course essential that steam-raising in paper mills should be absolutely smokeless and gritless, because of the immense harm that can be done to both paper and pulp in various stages of manufacture should grits and smuts be emitted from the chimney and so find their way into the incomplete manufactures.

The Bennis coking stoker for paper and pulp mills has been referred to more than once in these pages, it is, therefore, sufficient here to point to the fact that the installation described was a development due to a satisfactory experience with a similar installation at another of the Paper Co.'s mills.

The following are among a number of the advantages claimed for the Bennis coking stoker.

(1)—The power of rapidly lighting back which carries with it the power of feeding a much larger amount of fuel on to the furnace and getting it burnt.

(2)—A higher and more even furnace temperature than has hitherto been possible with coking stokers. This is induced by the scrubbing of the coke by the air blown into the fire through the very fine air spaces of the compressed air furnace bars.

(3)—Maximum flexibility attained by the power of controlling the air supply to the compressed air furnace bars and the adjustment of the damper of the boiler; a combination adequate to control the rate of combustion.

(4)—Combustion without smoke, grits or dust; the compressed air furnace cleaning into the ash-pit, which is a closed chamber.

(5)—Simple and easy manipulation, there being but two adjustments for the fireman to make, one which determines the rate of feed by turning a nut, and the other which regulates the air-feed by means of a valve.

(6)—Low cost of upkeep, the bars being few and the feed motion simple.

(7)—Stoking bars which keep the fire at a nicely-calculated distance from the boiler front, thereby obviating the hitherto unavoidable injury done to the whole furnace front by parts becoming red-hot.

(8)—Air-cooled fire-doors which prevent damage either to stoker or boiler.

George H. Tod, Manning Chambers,

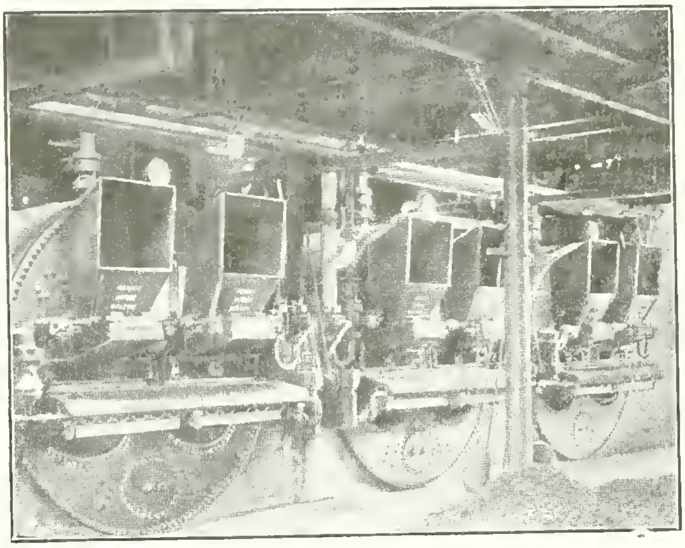
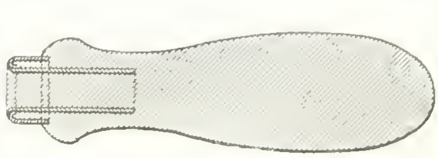


Fig 3—This range of "Bennis" Smokeless and Gritless Coking Stokers is in operation at the A. E. Reed & Co. Farncombe Paper Mills.

Toronto, is the Canadian representative of the manufacturers, Edward Bennis & Co., Bolton, England.

IMPROVED FILE-HANDLE.

THE illustration shows a patent file-handle, which is manufactured by the W. T. Nicholson & Clipper Co., King Street, Salford, Manchester. As will be seen, the handle is provided with a flanged steel tube, which is pressed into the wood at the end, and into which the file is driven. The flange of the tube overlaps the ferrule, which is formed



IMPROVED FILE HANDLE.

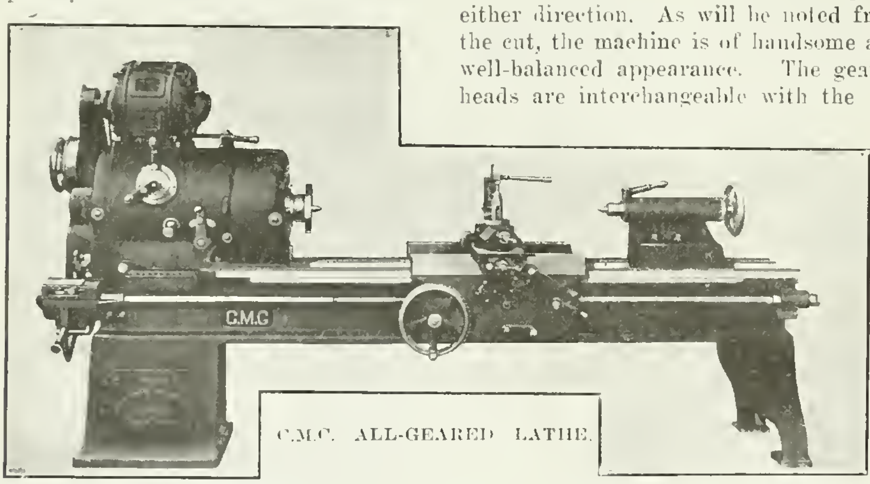
with an internal turnover at the outer end. The tube flange is tapered in order to fit snugly over the ferrule, the whole making a very neat arrangement. The use of the tube prevents any splitting of the wood when the file is driven in, and

also prevents the ferrule from coming off. There is thus no danger of the tang running into a workman's hand. The tube also serves a second purpose by so compressing the wood that the file is held much tighter than in an ordinary handle. This leads to an increased life for the handles, since they are not flattened on the end and destroyed by constant hammering.

C. M. C. ALL-GEARED LATHE.

WE illustrate herewith a new all-geared lathe recently designed and put on the market by the Canada Machinery Corporation, Galt, Ont. The cut shows the machine equipped with a direct current constant speed motor, but it may also be arranged for single pulley belt drive. Attention is directed to the head, which is of the totally enclosed, all-geared type, giving eighteen changes of speed from a single motor or pulley drive. This is accomplished by means of two sets of sliding gears and a double jaw clutch. The gears are all of forged steel, hardened where necessary, and with the ends of the teeth properly rounded on a special machine, so that it is no more difficult to obtain any of the eighteen changes than it is to obtain the speed changes on an automobile gear box. The driving pulley for the gear is provided with a friction clutch, so that the load may be released at the moment of changing the gears; and, as the gears are totally enclosed, it has been a simple matter to provide a lubricating system, so that the gears are running in an oil bath at all times and the journals are copiously flooded with oil. The head is so designed that it is impossible to engage two different sets of gears at the same time. The tooth clutches are made of hardened steel. The spindles are of extra high carbon steel, ground to size, and running in bronze bearings, and proper index plates are provided showing the different changes.

The design gives a maximum number of speeds with a minimum number of gears, only thirteen gears being necessary for the eighteen speeds. This results in a minimum number of parts, and the head is free from unnecessary complications. An interesting feature is the means provided for locking the spindle when changing the face plate; a special locking pin being provided, which enters a corresponding hole in the sleeve clutch on the main spindle and keeps the spindle from rotating in either direction. As will be noted from the cut, the machine is of handsome and well-balanced appearance. The geared heads are interchangeable with the ordinary three steps of the double-back geared heads on the other lathe products of the company.



C.M.C. ALL-GEARED LATHE.

Joseph Patton, of the Dominion Steel Corporation Bessemer Department, has returned from a three weeks' vacation to his home in Washington, D.C.

STAGGERED TOOTH STEEL GEAR.

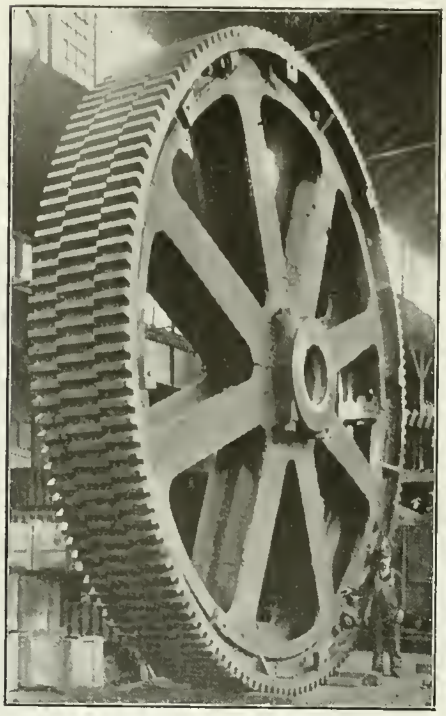


FIG. 1. LARGE TRIPLE-STAGGERED TOOTH STEEL GEAR.

A STEEL gear of unusual design, and probably the largest of its kind ever manufactured, was shipped recently by the Mesta Machine Co., of Pittsburg. The accompanying illustration, Fig. 1, shows this gear in the company's works at West Homestead, Pa. It was made for the Inland Steel Co., of Chicago, and will be used for driving a sheet mill. By the use of this gear and pinion, a single stage speed reduction is obtained from the motor to the mill.

The gear is 22 ft. 8 in. in diameter, 38 in. face, and of 5½ in. circular pitch. The mating pinion is 2 ft. 11 in. in diameter. There are 154 teeth in the gear, and 20 teeth in the pinion. The design varies from ordinary practice because the teeth are staggered in three sections. On account of the axial motion to which the drive is subjected it was necessary to use a spur gear. Herringbone gears were not considered because of the unequal pressures that would be exerted on the side of the tooth face. The gears travel at a speed of 2,000 feet per minute, and to meet the action of this high speed, the teeth are staggered and the drive arranged to run in an oil bath. The machining of the gear will doubtless prove of interest.

All the teeth were cut on a planer designed and built by the Mesta Machine Co., and shown in Fig. 2. In this machine, the tool is driven directly by a heavy lead screw which in turn is operated by a variable speed reversing motor.

The gear itself is built up of six parts. The gear centre, including the arms, etc., carries the central rim segments. The two halves of the gear are bolted together and the separate rims are fastened by bolts running through the side of the central casting.

Starting with the rough casting, the operation of making such a gear is as follows: After annealing the casting, the joints at the hub end rim of the central portion of the gear were planed. These joints were then drilled, reamed, and the two halves bolted together. The wheel was next placed in the pit lathe, the gear centre turned down to the correct diameter and the surface machined where the rim segments were to rest. The main gear was afterwards taken from the lathe and the rim segments machined. Lugs were cast on these segments to aid in holding the work on the face plate. One segment was bolted on the face plate and turned up. It was then reversed, the other side being machined to size, and the segment turned to correct diameter. The surface of the segment to rest on the main gear was also machined at this time. The rims were next bolted securely to the main gear centre with all the teeth in a

line across the face of the gear, as shown in Fig. 2. The teeth were then planed through the centre section and both side sections at the same time. The final cut was taken on the gear without removing the tool during the entire operation of cutting.

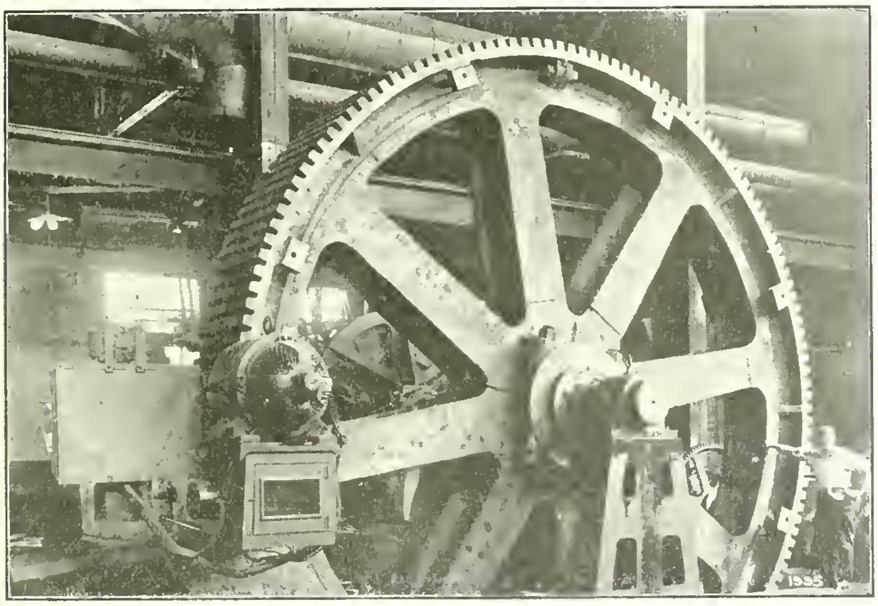


FIG. 2. LARGE TRIPLE-STAGGERED TOOTH STEEL GEAR IN GEAR PLANER, SHOWING METHOD OF CUTTING THREE SECTIONS OF TOOTH AT ONE OPERATION.

The mating pinion was machined in a way similar to that of the large gear. After the teeth were cut, the bolts were taken out and the two side sections shifted on the centre section to give the proper stagger. This was done by using an indicating micrometer, so that the slightest variation from exact dimensions could be eliminated. After the stagger of the teeth of the pinion was set, the teeth of the large gear were set to match the pinion. Holes were then drilled through both rims and the centre of the gear. These holes were reamed and machined bolts inserted. The gear was next taken apart and shipped, and since it is built up of six pieces, together with the fact that the parts were fitted together at the plant with machined bolts, the installation will be quite simple.

"WEAR-EVER" ADJUSTABLE SPACING COLLAR.

THE illustration herewith shows a new form of adjustable spacing collar designed primarily for use in milling machine manufacturing operations, where two or more milling cutters on the same arbor must be spaced exact distances apart. As those familiar with straddle or gang milling machine operations know, it is sometimes necessary to grind the sides of the teeth of the milling cutters. This, of course, changes the distance between the faces of the milling cutters, and, in order to maintain sizes on the piece being manufactured compensation must be made in some way for the amount ground off the cutter. This is sometimes accomplished by carrying in stock an assorted lot of solid spacing collars of varying lengths, and if the exact size cannot be found, provision must be made by grinding off a solid collar that is too long, or shimming up one that is too short, during which time the milling machine is standing idle.

The "Wear-Ever" collar is so designed that thickness may be varied a total of .024 of an inch, and this is divided into twelve spaces of .002 inch each. The adjustment of the collar is quickly made, and, after each adjustment, it is absolutely the same as a solid collar. With the threaded collar sometimes used there are inaccuracies due to the wear of the threads. This collar is now in use in a number of the larger automobile manufacturing plants.

ADJUSTABLE SPACING COLLAR

Some of the advantages claimed for it over threaded collars are as follows:—

1.—Threaded collars cannot be made less than 1 inch in width. The "Wear-Ever" is ½ inch or less.

2.—Threaded collars after short use become loose and inaccurate in the thread.

3.—Small chips fill the threads necessitating careful cleaning before adjustment can be made, whereas chips cannot interfere with the working of the "Wear-Ever."

4.—First cost of the "Wear-Ever" is low, thus allowing wide use in the machine shop without much investment.

Scully-Jones & Co., Railway Exchange Building, Chicago, are putting this collar on the market.

PRODUCER GAS FROM WOOD.

IN a lecture on "Producer Gas from Wood," recently delivered before the Junior Institution of Engineers, Mr. G. E. Lygo said that gas plant makers had given serious attention to the subject of utilizing wood for use in gas producers. In these plants all kinds of wood, from sawdust to pieces 6-in. diameter, cotton seeds, cocoanut shells, fibre and dust, sugar cane, coffee husks, rice husks, spent tanning bark, rubber leaf waste, surface peat, etc., could, he pointed out, be utilized.

Referring to the design of the plant, the lecturer said many points had to be taken into consideration which were not needed with an anthracite plant. The area of the generator was governed by the nature and size of the fuel, but, roughly speaking, it was 2½ times that required for coal fuel. The depth of the fuel depended upon its size and density. A deep fuel bed was necessary for large pieces of wood, for otherwise air passed through and ignited the gas in the top of the generator. Small dense fuel, such as sawdust and coffee husks, required a comparatively shallow bed, for the resistance of a deep bed would interfere with the working of the engine. The internal hopper must be designed to suit the fuel, some fuels falling evenly in the generator, while others formed a cone in the centre.

Removing Iron Rust.—One of the methods given is as follows:—Steep in a solution of chloride of tin; the time the pieces remain in the bath will be determined by the thickness of the coating of rust. Generally twelve to twenty-four hours suffices. The solution should not contain a great excess of acid. On taking the pieces from the bath, rinse first in water, then in ammonia, and dry quickly. The iron will have the appearance of dull silver, and on polishing will resume its normal appearance.

Robert A. Wilson, formerly of Galt, Ont., has resigned his position with the Ohio Steel Co., Youngstown, O., and accepted a position with the Oil Producer Co., Houston, Texas.

INDUSTRIAL NOTABILITIES--No. 20

ABOUT two years ago, an aggressive young man dropped into Owen Sound, and made the old place live again. While this northern seaport has a live mayor, has a magnificent harbor, and two lively semi-weeklies, yet, somehow, since the C. P. R. boats ceased to call there, and half the hotels in town closed their doors, there has been a sleepy atmosphere about the place that belies the big noise the name suggests.

When Hugo A. Gutenkunst came to town, he had an awakening in store. Every Ontario village loves a new factory, and the veriest Rip Van Winkle of a place will rub its eyes and show signs of life when an American business man comes along and talks of bonuses, free sites, and exemptions, for, nowadays, these words mean new industries.

Owen Sound took Hugo Gutenkunst to her arms, and now, some distance from the railway station, there is one of the most up-to-date malleable iron plants in Canada, with a most aggressive man at the head, keeping it busy with orders from railways and implement manufacturers. The Canadian Malleable Iron Co. plant may one day be to Owen Sound what the Canadian General Electric is to Peterborough.

The president comes from Milwaukee, where he attended grammar and high schools, and took a chemical and mechanical engineering course at the University of Wisconsin. During his younger days, he spent his holidays in his father's factory, so that he was thoroughly

HUGO A. GUTENKUNST.

acquainted with all phases of the foundry business before he left college. He entered his father's plant at the age of twenty. He worked through each department as any other working man would do, and in this manner became acquainted with every phase of the business.

After several years of this training, he was made assistant superintendent, and finally general manager. This position he held for a number of years, during which he designed and built a large new edition.

About this time, Mr. Gutenkunst decided to go into business for himself, and designed and built the Dickson Malleable Iron Co. plant at Milwaukee, Wis., of which company he became vice-president and superintendent. T'is plant was conceded at the time of its erection to be one of the best laid out and equipped malleable iron factories in the United States.

He sold out his interests in this plant and made a trip through the United States, Europe, and Canada. He decided that there was a large opening in the malleable iron line in Canada. This brought him to Owen Sound, where he built the present fine plant of the Canadian Malleable Iron Co., Ltd.

Mr. Gutenkunst is a member of a number of clubs, both in the United States and Canada, among them being the Deutscher Club, the Milwaukee Athletic Club, Milwaukee Automobile Club, all of Milwaukee, Wis., the Sydenham Club, of Owen Sound, Ont., and the American Club, of Toronto. He is interested in several concerns in the States, and is vice-president of Canada Beds, Limited, Chesley, Ontario.

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Vol. XI. FEBRUARY 5, 1914 No. 6

PRINCIPAL CONTENTS.

THE BUSINESS OUTLOOK.

TO all appearance the business depression in Canada struck bottom some time since, if we might judge by the reports of improving tone in the machinery and allied trades. Easier money conditions now prevail, and what is perhaps the most potent feature of all, people generally have become optimists. As remarked on a previous occasion when the descent was still in progress, everybody was lending their weight to accelerate it, and as becomes human nature, all hands are now engaged in the elevating process.

The development and progress of Canada, dependent though it be to a large extent on conditions in other countries must go on, and in this connection there is just the possibility that more of the financial assistance so generally received from Great Britain will this year be forthcoming, if, as is generally believed, the crest of the wave of industrial prosperity there was reached in the closing months of 1913.

THE ATTRIBUTE OF HONESTY.

SOME time ago, a contemporary drew attention to the revelations concerning the New York, New Haven and Hartford, and the Boston and Maine Railroads, and expressed the opinion that, while enforced honesty by means of legislation was not only undesirable, but impossible, there was need of more effective measures than those now in vogue to make the crooked walk straight. Not a day passes, but the business and commercial life of this and every other continent is besmirched through the lack and practice of simple honesty by men in high places. In the humbler walks of life we are more or less prone to expect a considerable display of dishonesty, but just why, in this particular feature, none of us may be able to give a reasonably intelligent answer.

The dishonesty that is rampant in high places is becoming so common and brazen that it passes for smartness, and in a certain sense it earns the latter title so long as the malpractices remain undiscovered. The stress of keen competition in any and every sphere of the activities of our being contributes largely to the practice of dishonesty in a variety of form, and as this determination to get ahead of the other fellow is growing in intensity all the time, the outlook seems not altogether one for decrease, but rather increase. Referring again to the New Haven railroad, we have the declaration of a high official of the Government, following a careful investigation of conditions that "the powers that were did everything except run a railroad."

Education, philosophy and cultivation of intelligence are not only now within the reach of all who care to avail themselves of their acquirement, but are in addition being appropriated and effectively applied in the testing of men and things material, and only the lack of the most elementary intelligence on the part of a large percentage of men in high places, or a surfeit of avarice blinds them to the fact that they are being shadowed by the detectives of public opinion. In politics and affairs municipal, votes are paid for directly and indirectly, and in too many industrial and other corporations, the prosperity of the financier, and not the commercial interests of his community or his country, much less the welfare of the employees is the sole ideal. Is it surprising, therefore, when the names of some public men are mentioned that suggestions of honesty—plain, simple, downright honesty, are ridiculed?

Finance enters into all enterprise as a necessity, but finance, it is too often forgotten, is but a means to an end, and not that end. How often, however, do we find it both the means and the end, and the latter in more ways than one. Many industrial enterprises would still have been in existence had high finance not crushed them out, and many of those which to-day are wobbly would have been firmly established and flourishing had the like sinister influence not been allowed to usurp the real purpose of their being. Legislation, however drastic, will never make men honest, if for no other reason than the fact that those who legislate for us come far short of infallibility with respect to wisdom, justice and even common-sense. It may be said in reply that our rulers are but a reflection of ourselves, but this is only true in part, for it cannot be said wit' honesty of conviction that they are so representative.

Business enterprises, if run as purely financial institutions, are a menace to the progress and development of any country, and affect unfavorably the welfare of its citizens, besides courting ultimate ruin for those directly interested. In support of this statement, we don't have to cast around very much or very far for convincing proof. Much has been written relative to the display of earnest, honest, whole hearted effort on the part of employees, but little is to be found which calls for honest business methods and administration on the part of those to whom this duty and privilege has been given.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3....	20 00	21 50
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3.......	20 00	22 00
Clarence, No. 3........	20 50	21 00
Jarrow	.....	23 50
Glengarnock	......	26 00
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1........	19 40	18 35
Victoria, No. 2X	19 15	18 10
Victoria No. 2 Plain ..	18 90	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh.........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal......	2.10
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh.....	1.20
Steel hoops, Pittsburgh..........	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ in., 100 lbs...	$2 30	$2 20
Heads, per 100 lbs.......	2 55	2 55
Tank plates, 3-16 in......	2 60	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	9 00	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate Washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb off
Nuts, Hexagon, all sizes..	4½ per lb off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, bronze	70, 10, 7½, 10 p.c. off

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in...	75%
Finished Nuts over 1 in....	72%
Semi-Fin. Nuts up to 1 in..	72%
Semi-Fin. Nuts over 1 in...	72%
Studs....................	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 00	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings..	9 00	9 00
No. 1 wrought iron.....	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	13 00	12 00
New brass clippings....	8 50	8 75
No. 1 brass turnings....	7 25	7 50
Heavy lead	3 75	4 00
Tea lead	3 00	3 00
Scrap zinc	3 00	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$. 32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	.....	....	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in. ..	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$16 00	$16 25
Electrolytic copper	15 75	15 75
Casting copper	15 50	15 50
Spelter	5 25	5 25
Tin	42 00	42 00
Lead	5 25	5 40
Antimony	8 50	8 50
Aluminum	21 00	19 00

SHEETS.

	Montreal.	Toronto.
Sheets, black, No. 28	$2.75	$2.90
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	4.00	4.15
Apollo brand, 10¾ oz. (American)	4.30	4.10
Queen's Head, 28 B.W.G.	4.40	4.20
Fleur-de-Lis, B.W.G.	4.20	4.20
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.40	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal.	0.23
Pure turpentine	0.66
Linseed oil, raw	0.62
Linseed oil, boiled	0.65
Plaster of Paris, per bbl	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Feb. 2, 1914.—Money is gradually becoming easier, the result making itself felt in the steadily-improving tone of the stock market. The rising prices of leading stocks form an encouraging sign that the present depression in trade is passing away. Present indications are that some little time must still elapse before business resumes its normal volume; in other words, the improvement is likely to be very gradual. The fact that people still have plenty of money to spend on luxuries is another proof that times are not so bad as some would have us believe. A record is said to have been made in the matter of sales at the Montreal motor show, the pleasure car section of which closed on Saturday last. The commercial car show opens to-morrow for the balance of the week, and will be a thoroughly representative exhibition.

The demand for pig iron continues fairly good and prices remain firm. The position of the steel and iron market is also improving.

Copper continues to show an improved tone, but the feature of the metal market is the rise in tin which has taken place during the past week. It is now being quoted locally at $42.00, as against $40.00 a week ago. This is due to bull manipulation on the London market, and in view of the present statistical position of this metal, the price is likely to remain high for some time. This at least is the opinion expressed to-day by a prominent Montreal firm of metal merchants.

There is a well-defined rumor circulating to the effect that the Borden Government are about to reduce the import duty on agricultural implements. It is stated that they will not accede to the demand for free wheat, which is being strongly opposed by the milling and railway interests. The Government take the stand that while refusing to grant free wheat, it will assist the farmer by reducing the duties on his implements.

The coming spring will see still another line of steamships on the St. Lawrence, as the Hamburg-American Line, who have just opened an office here, will then commence a freight and passenger service between Hamburg and Montreal. In fact, they are to commence their Canadian passenger service during the present week with the sailing of S.S. Armenia from Hamburg for Halifax, N.S., on February 7. This service, however, will only be westbound until navigation on the St. Lawrence opens again.

Toronto, Ont., Feb. 3, 1914.—An Ottawa foundry proprietor remarked to one of our representatives recently that Summerlee pig iron was not being quoted in Canadian Machinery, adding that he had been buying that for years in Montreal. Summerlee pig is made in Great Britain, and is considered one of the best made for a certain kind of work. There are several manufacturers up and down the country who will pay almost any price for this brand, but, for the present, it is off the market, the price being too high to compete with Canadian and American iron. Drummond, McCall & Co., Montreal, we understand, still supply it to some of their old customers who insist on having Summerlee.

The pig iron market is gradually improving with business generally, and the price is tending upwards. The prices quoted in Canadian Machinery for Victoria brands are chiefly for small quantities, better prices being available for large quantities.

Steel Market.

The demand for steel bars, etc., from warehouse is not very big at present. Warehouse customers are now able to buy from mill, as three weeks' shipment can be guaranteed. That condition, however, will not last for long. Most buyers of steel are getting under cover. The larger consumers feel that the market will shortly be rising, and do not wish to buy at high prices. Demands for steel are not confined to one class of manufacturer. Orders were placed this week by a large engine works, an elevator firm, a firm manufacturing fire doors, another making ornamental stairs, two structural steel firms, and a large boiler-maker.

One of the features of the week has been the big demand for supplies from large boiler manufacturers and shipbuilders. The boiler tube trade is opening up splendidly, chiefly for new boilers and railroad work. The tendency is to use seamless tubes for stationary boilers. Shipbuilding firms in and around Toronto bought heavily during the last three months, and the steel is now on the ground.

Canal Contractors Buying.

Contractors on the new Welland Canal are buying extensively from warehouse, their chief requirements being wire rope, plates, bars, tubes, etc. The order for steel plates for making the Toronto intake pipe has been placed by the Thor Iron Works with Drummond, McCall & Co., Toronto, amounting to about 1,000 tons. This will be supplied by the Carnegie Steel Co.

The price of steel sheets is stiffening up. The price of all sheets dropped considerably during the latter half of 1913. There is a fair demand. Prices of bars, bolts, etc., and wrought iron pipe are unchanged. Some of the implement makers bought steel bars during the week, but business is not big enough yet to warrant large purchases. Canadian steel companies are preparing to increase their price of steel bars following the stiffening across the line. The Steel Company of Canada are operating their furnaces at Hamilton full.

Machine Tools.

While the steel business shows marked signs of improvement, the machine tool and supply market continues quiet. This business will have to wait until the basic trades have got into good shape again. There are several small inquiries for machine tools, small orders being rather plentiful, which is a hopeful sign, showing that the general tone is good. No-

thing has been heard yet regarding the big order for machine tools required by the Michigan Central Railway for their new shops at St. Thomas. In the Windsor district, from which inquiries usually come freely, things are quiet. The Hamilton Bridge Co., Hamilton, who were in the market recently for a large number of tools, have placed their order.

St. John, N.B., Feb. 2, 1914.—The approach of spring sees many hopeful signs with regard to industrial progress and activities in the Maritime Provinces and various firms are planning business development. Plans were last week laid before the city commissioners for a manufacturing plant on the Marsh Road involving an outlay of $2,000,000 by George McAvity and A. P. Barnhill, the plant to give employment to about 1,500 men. A request was made for a fixed tax rate for a period of forty years, the company undertaking to pay $5,000 in taxes each year if the request were granted. Mr. Barnhill said it was the intention to form a new company to take over the McAvity business and enlarge it, and that the capital for the new concern was already assured. The initial unit of the plant to be erected on the Marsh Road would cost about $300,000 while extensions contemplated would would make a total expenditure of about $2,000,000. The company desires the right to rail connections with the I.C.R. with a level crossing, and to supply electric light, power and telephone service, and to carry wires to its buildings on either side of the road. An agreement in the matter will be made at a later date.

A new pork factory, with modern equipment and large capacity is to be established in St. John. To accomplish this, a company has been incorporated by Provincial charter under the name of the New Brunswick Packing Co., Ltd. Organization has been completed with the following board of directors:—J. M. Robinson, president of the Board of Trade; D. F. Pidgeon, A. C. Corfield, C. N. Kennealy and W. W. Corfield. T. H. Foster has been appointed secretary-treasurer, and Barton, Mayhew & Co., auditors. The authorized capital stock is $99,000. The factory will be modern in every particular.

The contract for the concrete superstructure for the new wharves at Carleton has been awarded to the E. G. M. Cape Co., Montreal, who are now in charge of the massive stone work being erected at the plant of the Atlantic Sugar Refineries, Ltd. They will assemble a complete and powerful equipment for their operations which will be started in April. The crib work will be built by D. C. Clark, of St. John.

ANNUAL MEETING OF C. S. C. E.

THE Canadian Society of Civil Engineers held their twenty-eighth annual meeting in Montreal, January 27-28, when Mr. M. J. Butler, of Armstrong-Whitworth, of Canada, Ltd., was elected president for the current year. Mr. R. A. Ross, the well-known Montreal consulting engineer, was chosen vice-president. The vote on the members of the council, who sit for three years each, resulted as follows:—

District No. 1, J. M. R. Fairbairn, H. M. McKay; No. 2, R. McCall; No. 3, A. R. Decary; No. 4, R. F. Uniacke; No. 5, W. A. Buck; No. 6, F. Lee; No. 7, I. R. C. Conway.

According to the financial report, the receipts of the society for last year amounted to $22,506, made up principally from dues, which came to $21,386. The property at 176 Mansfield street, valued at $91,500, is owned by the society. In addition to this, there is a bank deposit of $5,000, books valued at $6,000 and nearly $300 in cash on hand as well as various other assets. A mortgage of $20,000 on the property is the chief liability.

At the first session on Jan. 27, an important resolution was adopted calling upon the Dominion Government to take up the question of co-ordination of surveys and the establishment of some system of recordiong information as to surveys and maps in such manner as to make it available not only for the public but for all the Government departments as well. At present one department has no means of learning what is being done in another department, and it was felt by the society that this state of affairs should not be allowed to continue. Some years ago, the Government appointed a commission consisting of heads of departments, and this commission presented a report but no further progress was made.

It is now proposed that the work be taken up where the commission left off, and the Government will be urged to provide a system for the exchange of information between departments and thus eliminate the overlapping that now takes place.

At the afternoon session, Jan. 27, a new committee was appointed to revise the society's specifications for cast iron water pipes. Afterwards, the retiring president, Mr. Phelps Johnson, gave his annual address in which he drew attention to a feeling that had been voiced by some members against the admission of foreign engineers to take charge of works in Canada. This he thought a mistake, and warned them against adopting labor union methods. He also thought the members lacked enthusiasm for the welfare of the society, and urged them to take a more lively interest by providing and reading papers on engineering problems at short intervals.

On the second day of the convention the members paid a visit to the works of the St. Lawrence Bridge Company, at Rockfield, and in the evening the annual dinner was held in the Engineers' Club. Mr. H. H. Vaughan, a past-president, presided in the unavoidable absence of Mr. Phelps Johnson.

The third day was occupied largely with routine business, announcement of elections of officers, etc. The convention was attended by 340 members drawn from all parts of the Dominion.

INDUSTRIAL WELLAND DURING 1913.

THE accompanying figures and data relative to the industrial activities of Welland, Ont., during 1913, were recently presented to the members of the Board of Trade of that town, and serve to show that no lack of successful effort marked the work the industrial commissioner, Mr. B. J. McCormick.

Mfg. plants in operation, 25; increase over 1912, 3.
Employees on 25 pay sheets, 2,872; increase over 1912, 196.
Wages paid by 25 plants, $1,642,996.25; increase over 1912, $158,849.25.
Product shipped by 25 plants, $8,835,573.00; increase over 1912, $1,770,607.00.
Improvements charged to capital account by 25 plants, $1,733,490.72; increase over 1912, $1,169,825.00.
Building permits inside town limits, $611,157.50; increase over 1912, $141,413.50.

During the year three new manufacturing concerns were secured and are now erecting plants.

Marine

Ottawa, Ont.—The estimates include a sum large enough to finish the Trent Valley Canal. The last contract for the upper end will be let this month, and the work below Peterboro will all be done by August 1st. Every effort is being made to get this waterway opened as soon as possible.

Prince Rupert, B.C.—Activity is now being manifested at the $3,000,000 drydock under construction for the G.T.P. railway and steamship interests. Immense quantities of steel for structural purposes, lumber and machinery are arriving weekly, the last being a 1,500-ton consignment now being unloaded from the steamship Kentra. The steel frame of the foundry is finished, and that for the numerous other buildings will shortly be in place. The floating drydock, according to plans furnished by William T. Donnelly, will have a lifting capacity of 20,000 tons, and is so designed as to be capable of operating in sections as a number of smaller docks.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Stratford, Ont.—The Grand Trunk Railway Co. is contemplating building new shops here.

Owen Sound, Ont.—A plant for the manufacture of steam rollers and a box factory are expected to locate here.

New Westminster, B.C.—An American steel company is negotiating with the city for a site on which to build a plant.

Niagara Falls, Ont. — The Dominion Chain Co., Ellen avenue, are asking the town for a free site on which to build a plant.

Berlin, Ont.—Work on the automobile factory to be built by H. Nyberg will begin early in March. It will measure 250 x 250 feet.

Toronto, Ont. — Foundry Specialties Co., Cherry street, have had plans prepared for the reconstruction of their foundry. W. S. Thompson, Toronto, architect.

Brantford, Ont. — Templeton Bros., makers of electric ranges, whose plant was recently destroyed by fire in Toronto, have been here looking for a site on which to build.

Fort William, Ont.—The Orpen Conduit Mfg. Co., of Canada, Toronto, who were contemplating the erection of a plant in Fort William, have shelved the matter meantime.

Winnipeg, Man.—The Oribo Manufacturing Co. has been incorporated with a capital stock of $50,000 by John Brockest, Harry S. Price, and others, to manufacture sheet metal, etc.

Toronto, Ont.—A foundry and machine shop will be erected by the Eureka Smoke Consumer Co., of Canada, Ltd., who will manufacture smoke consumers, etc. Sydney H. Stott and M. S. Gooderham are interested.

St. John, N.B.—The Portland Rolling Mills have secured the contract for supplying the Intercolonial Railway with refined iron for the year. The contract will keep the plant running for a year.

Halifax, N.S.—It is understood that at the next annual meeting of the Nova Scotia Car Works, Ltd., announcement will be made that the company proposes to enter on the manufacture of structural steel.

New Westminster, B.C. — The Heaps Engineering Co., Ltd. advise that owing to the financial stringency construction work on their new plant has been abandoned, and orders for tool equipment delayed indefinitely.

St. Catharines, Ont.—A portion of the plant of the Steel and Radiation Co., which has not been used for some time will be operated this week, and the number of employees increased by thirty. New machinery is being installed.

Lethbridge, Alta. — The Automatic Hose Coupler Co., at their annual meeting, recently, decided to erect a factory here. The company is capitalized at $100,000. An American concern is at present manufacturing this coupler.

MACHINE TOOL INQUIRIES.

The De Laval Dairy Supply Co., Peterborough, Ont., who recently erected a plant for the manufacture of cream separators, etc., have transferred a large quantity of machine tools from their old factory in St. Johns, Que. They also purchased a number of second-hand tools about a year ago. Additional equipment is now required to complete their outfit, consisting of: One cutter grinder, one tool-room lathe, one 20-inch drill, one 30-in. planer, one heavy duty drill, one 24-in. shaper, and one horizontal boring, drilling and milling machine.

Another order that several houses are trying to land is that for a traveling crane and a pipe and bolt-threading machine for the Loughead Machine Co., Sarnia. This firm states that the majority of machine tools required for their new shop have already been purchased.

Pembroke, Ont.—The Steel Equipment Co., Ltd., who have built a new factory, advise that they took over the plant and equipment of the Eclipse Mfg. Co., and have all the machine tools they require meantime. D. P. Cruikshank, managing director.

Calgary, Alta.—The Alberta Wire Nail Co. have asked the city for a loan of $50.00 to increase the capacity of the plant. From 110 to 125 kegs of nails are being turned out daily, and an extension is necessary to cope with orders. O. G. Devenish, manager.

Pembroke, Ont.—The Steel Equipment Co. has completed in the west of the town a reinforced concrete factory, 100 by 400 feet, where it will manufacture steel office equipment such as filing cabinets, vault fittings, etc. This company bought out the Eclipse Mfg. Co.

Quebec, Que.—H. C. Carrier has rented the shops formerly occupied by Carrier, Laine & Co., of Levis, and after making extensive repairs to the plant, will start up in the general engineering business. These premises were last occupied by the Canadian Shoe Machinery Company.

Sydney, N.S. — The Dominion Steel Corporation plant, which had been closed down two weeks for repairs, reopened last week. Mr. C. Stanley Martin, general superintendent, stated that sufficient orders have been received to keep the works going at full blast until well along into the summer.

Toronto, Ont.—It is unlikely that the Board of Education will buy machine tool equipment for the new Technical School until early next year. In the meantime, however, four motor-driven lathes, and perhaps a milling machine, will be purchased for the old school. J. W. McBean will issue the specifications.

Sault Ste. Marie, Ont. — Vice-President J. Frater Taylor of the Lake Superior Corporation stated last week that his company has decided to let the contract at once for the construction of another open hearth furnace at the big steel plant. This is the first step in the company's proposed scheme to spend upwards of three million dollars on extensions.

Toronto, Ont.—R. J. Fleming, general manager of the Toronto Railway Co., announces that plans are being prepared for the construction of two new barns, and for the overhauling of 500 street cars. The general manager stated that work on the cars would be commenced as soon as the 25 new ones now in hand were completed.

Ottawa, Ont.—The Campbell Steel & Iron Co., Carling street, have built foundations for an extension to their blacksmith shop, 40 x 60 feet, to be completed in the spring. A one-storey extension to

the erecting shop, measuring 100 x 100 feet, will be commenced early this year, part of which will be used as a machine shop. The firm will supply the necessary structural steel themselves.

Maple Creek, Sask.—The Gilbert Hunt Manufacturing Co. have purchased a site on Jasper street, and in the spring will erect a plant costing between $75,000 and $100,000 for the manufacture of farming implements of all kinds, employing from 400 to 500 men. The Maple Creek Light, Power & Milling Co. will supply the power. The directors are: Gilbert Hunt, J. H. Fleming, D. Kearns, R. S. Hodson, and others; the capital, $700,000.

Collingwood, Ont.—The Imperial Steel and Wire Co., Ltd. will add a screw and bolt mill to their plant, employing 60 additional hands per shift, and costing not less than $50,000. Up to the present, the company have manufactured wire and nails, their output running to over forty tons of finished material per day, and over a million dollars a year. The town is asked to guarantee their bonds to the extent of $100,000, and voting on a by-law takes place on Feb. 24. J. A. Currie, president; S. H. Lindsay, manager.

Lindsay, Ont. — The Boving Co., of Canada, who recently purchased the Madison-Williams plant here to manufacture their hydraulic machinery, laid foundations for an addition to the machine shop, but frost came before the walls were up. Temporary walls were however, erected. Castings from 7 to 8 tons are now being made in the foundry, but a new up-to-date shop will be erected during the coming year, to be used as an iron and brass foundry. The present foundry will then be used as a pattern shop. The contract for structural steel will be let this week.

Electrical

Stratford, Ont.—Extensions to the electric lighting system will be made.

Montreal, Que.—A new signal service system for the police force will be installed at a cost of $100,000.

Prince Rupert, B.C. — The city will spend $45,000 on an extension to the electric light pole line system.

Nickelton, Ont.—The Canadian Nickel Corporation are preparing plans to generate their own electric power at this point.

Terrebonne, Que. — The plant of the Terrebonne Light, Heat & Power Co., recently suffered by fire to the extent of $4,000.

Fort William, Ont.—The Street Railway Committee are negotiating with the Kaministiquia Power Co. for the purchase of a generator.

Brantford, Ont.—The Waterworks Department will probably be in the market shortly for an electric pump, costing about $25,000.

Regina, Sask.—Superintendent Bull, of the civic power department, has recommended that slot meters be installed for light consumers.

Parry Sound, Ont.—By-laws providing $4,500 for rights on the Seguin River that would give the town power for its waterworks and light plant have passed.

Embro, Ont.— The Township Council of East Nissouri are taking steps to see that the proposed Hydro radial from London to Stratford passes through the township.

Goderich, Ont.— The Marine Department has decided to install at the Port of Goderich one of the most powerful electrically operated fog horns in Canada.

Killarney, Man.—The Killarney Electric Light Co. has changed hands. The former owner, Mr. Collison turned the plant over to the purchaser, Mr. Vipond, on February 1.

Paris, Ont.—G. H. Armstrong, electrical commissioner, has informed the town council that $15,000 more will be required to complete the installation of the hydro system. Already $25,000 has been spent.

Thamesford, Ont.—Hydro power was turned on Tuesday, Jan. 27. The municipality is consuming 210 h.p. There are 32 ornamental lights about the streets. Several mills in town have contracted for the current.

Kelowna, B.C.—Active operations are planned in connection with the Belgo-Canadian Land Co., hydro-electric project at Mission Creek, 15 miles from Kelowna, in the Okanagan Valley. It is proposed to develop 2,000 h.p.

Collingwood, Ont.—The Imperial Wire and Steel Co. have made a contract for 350-h.p. Hydro-Electric power, to be supplied some time this month. Another 100 h.p. will be necessary for a new addition shortly to be erected.

Maisonneuve, Que.—The shipbuilding plant of the Canadian Vickers, Ltd., will be driven by electrical motors, constructed in England by Vickers, Ltd. Current at 10,000 volts will be supplied by the Montreal Light, Heat & Power Company.

Durham, Ont. — The passing of the Hydro by-law in Hanover may possibly hurry the development of the water powers on the Saugeen, of which there are many good ones. Durham has asked the Commission for quotations on 1,500 horse-power.

Englehart, Ont.— The Englehart and Charlton Power Co. expect to complete their power plant at Charlton by May 1. Should additional power be required, arrangements have been made for the development of a further fall of water which would give several extra thousand horse-power.

Fredericton, N.B.—F. W. Barbour, consulting engineer, Boston, has advised the council not to accept the proposition of the Eel River Light, Heat and Power Co. to furnish power to operate the pumping station. He recommended certain changes in the pumping station and filtration plant.

Longueuil, Que. — The Armstrong, Whitworth Co., of Canada, who are building a plant at Longueuil, Que., propose to install a power and lighting plant. Current will be supplied by the Montreal Light, Heat & Power Co., at 22,500 volts, which will be transformed to 2,200 volts.

Fort William, Ont. — For lighting at places yet to be named, the Fire, Water and Light Committee recommend that 50 arc lamps be purchased immediately. The question of fire alarm boxes has not yet been settled. The box made by the Star Electric Co. is to be looked over. The price asked is $102.

Cobalt, Ont.—Negotiations have been concluded for the supply of 800 h.p. to the Tough-Oakes mine in Kirkland Lake. The power will come from the Englehart and Charlton Power Co., Charlton, Ont. A motor-driven air compressor with a capacity of at least 1,200 cu. ft. free air per minute at 100 pounds, will be installed by the Tough-Oakes Co. immediately.

Electric Furnaces.—Two electric furnaces are now in operation at Trollhattan, Sweden, producing ferrochrome from ores brought from South Africa and New Caledonia. Four grades of metal, containing 5, 6½, 7½, and 9 per cent. of chromium, are produced, the current used being 3-phase, 50-cycle, at a voltage varying between 45 and 60 volts. It is stated that the furnaces require 1,700 k.w.-hours per ton of metal reduced, and that the results so far obtained have been satisfactory.

Development of Chain Gearing for Power Transmission--I*

By H. T. Hildage

Chain gearing as a possible solution of the problem of furnishing an improved means of transmitting power to machines in factories and workshops is dealt with in the accompanying article, while a resume is also given of the progress made in design, manufacture and application as exemplified in modern installations.

IT is obvious that transmission combining the positiveness of spur or helical gearing with the flexibility of belt or rope driving would be likely to attain more nearly the theoretical efficiency of either, and by virtue of this fact and its general adaptability would be very nearly an ideal transmission for the numerous and comparatively small drives in factories and workshops. The ideal transmission may be defined as the one having the following characteristics:

Positiveness.—There must be no possibility of slipping or flinching either under the ordinary running load, under ordinary impulses, or under temporary overloads of considerable magnitude.

High efficiency.

Flexibility.

Absence of narrow or rigid limitations as regards distance between shafts.

Durability.

Quietness of running, and freedom from vibration.

Low cost, both for installation or maintenance.

Elasticity of Ratio.—It should be of such a character that in any specified case it will be possible to obtain readily changes in the speed ratio.

Chain-gearing Claims.

Having thus indicated the pressing need for an improved method of transmitting power to machines in factories and workshops, and the qualities that would be required, we may proceed to consider chain-gearing as a possible solution of this problem, to examine how far it will fulfil the requirements, and to see what progress has been made in the development of its design, manufacture and application. Taking the requirements in order, and, with reference to the positive drive feature, it is obvious that chain-gearing is a positive transmission.

Efficiency.

The calculated efficiency of a chain drive under the worst circumstances of size of wheels and ratio is over 99 per cent., and the calculation takes account of all losses that are of serious consequence, but does not take account of any friction in the bearings of the shafts that are being connected, not even that portion of the friction due to the driving pull. The difference between perfect and commercial conditions for chain-gearing is not such as to detract seriously from its efficiency. A number of experiments made for the purpose of measuring the efficiency of chain drives have shown it to be between 96 and 98½ per cent., and in these cases the losses include not only those due to the chain itself, but also those due to such part of the resistance in the ball bearings of the motor and generator as were induced by the driving pull on the chain. If a chain drive receives ordinary care and reasonable lubrication during its life, its high efficiency is maintained until the chain is completely worn out. In the case of ropes and belts, the result of neglect is a mere falling off in efficiency, which, while costly, is imperceptible. With chain-gearing as with any other mechanical contrivance, negligence is rapidly destructive, and immediately attracts attention.

Flexibility.

Chains are, of course, quite as flexible as belts or ropes, and their flexibility does not depend upon any bending of material. The bending takes place about a properly-prepared bearing which is specially designed to reduce friction and keep wear at a minimum.

Shaft Centres Limitations.

There are limitations of the distance between the centres of shafts to be connected, but they cannot be said to be either narrow or rigid. The minimum centre distance for a chain drive is the sum of the radii of the smallest wheels that can be put on the shafts to give the required ratio of reduction, and this, in general, does not exceed the centre distance for a corresponding spur wheel drive. The maximum centre distance, which to some extent depends upon the inclination or "lie" of the drive, is about 20 ft. Small variations in the centre distance are of no consequence—that is, the efficiency and satisfactory working of the drive no more depend upon the distance between the shafts being an exact figure than in the case of ropes of belts.

Durability and Quietness.

The fulfilling of the first condition depends upon the excellence of design and the quality of workmanship and material used in the manufacture of chains and wheels, and the discussion of the design and application that follows will make it evident that chain drives are usually quiet, free from vibration, and sufficiently durable to be reliable, and economical.

Low Cost.

In first cost, the mere substitution of a chain for a belt or rope, without any other change in the conditions, would not, as a rule, be economical. In all probability a chain drive would often cost more than a spur wheel drive for which it was substituted, but if it were possible to remodel the conditions of a rope or belt drive, so as to make them suitable for chain-gearing, the total cost of the installation would usually be less with chain-gearing than with belts or ropes, because shorter centre distances will be used, larger ratios will be possible, and other modifications and economies in design and arrangement will be made.

Again, if cost be defined as the total cost, including first cost, maintenance, depreciation, interest, and power absorbed in transmission, it is comparatively easy to demonstrate that chain-gearing is much cheaper, where it is applicable, than non-positive drives.

Elasticity of Speed Ratio.

In the present state of its development, chain gearing will not readily fulfil this requirement. There is, however, a possibility of its doing so in the near future.

Chain Requirements.

Bearing in mind the importance of efficiency, durability, quietness in running, and freedom from vibration, the requirements of a satisfactory chain can be stated as follows:—

It must be so formed as to be capable of gearing with suitable wheel teeth in such a way that it will enter and leave the wheel without great loss of power, and without noise.

The joints must be so designed and made as to be capable of resisting wear for a long period of time.

Wheel Requirements.

The requirements of satisfactory wheels are:

That the tooth form shall be such that a suitable form of chain link will gear with it, with as little impact as possible and without friction, will remain in gear, and will leave freely and without friction. Small increases in pitch of the chain, due to inevitable wear, must not detract from the satisfactory fulfilment of the first condition. There are two principal solutions of these requirements—the so-called silent and bush roller chains.

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*From a paper read recently before the Manchester Association of Engineers.

Silent Chain.

The silent chain, patented by Mr. Hans Renold in 1895, which runs on the face of its wheel after the manner of a belt, consists of a series of flat plates with working faces formed upon them, and fitted with bushes or bearings of some type or other, and strung together upon a stud. The angle between the working faces is usually 60 degs., and these working faces engage with the tooth form of the wheel, which is a plane surface. From a study of the action of the chain on entering and leaving the wheel, the only impact, that on entering, is produced by the angular movement of the link about one of its pivots. There is no sliding on the tooth faces, therefore, the silent chain when new is an almost perfect solution of the problem.

The working face of the chain when it has become extended in pitch engages with the working faces of the wheel teeth at a higher level—that is, on a larger pitch circle, and consequently between the position of the chain when it is new and as deeply in engagement as possible, and its position when it is in danger of riding over the tops of the teeth, there is no change in the method of gearing, and consequently the efficiency is unaffected.

This is the consideration that fixes the limit to the useful life of the chain, and the aim of the designer must be, as far as the chain is concerned, to make the wear of the bearings proceed as slowly as possible until the limit of permissible extension, and consequently useful life, is reached, and, as far as the wheel is concerned, to make the depth of the teeth as great as possible, so that the permissible extension, and consequently the useful life, may be increased.

Link Form, Silent Chain.

The important features in the design of link form are the pitch, the angle between the working faces, and the radius of the tangency circle, or the distance from the centre of the pin to the working face.

The pitch or distance between the studs will depend upon the range of powers that the chain may be required to transmit, and upon the range of speeds that it will be required to operate at.

Silent chains of the same pitch are made in different widths. When the pitch of the chain that it is proposed to use is fixed by the speed at which it must operate, the required strength is obtained by varying the width of the chain or the number of links that are threaded upon the stud in each combination. It will be seen later, in considering the number of teeth in the wheels that, for higher speeds, smaller pitches must be used.

It should also be remembered that where exceptionally smooth turning is required, as, for example, the driving of some kinds of grinding machinery, it is necessary to use wheels with a large number of teeth, and this also means a shorter pitch. After all, a chain wheel is not a perfect circle, but a polygon having as many sides as the wheel has teeth.

The angle between the working faces mostly commonly used is 60 degs. Other angles, both larger and smaller, have been tried, but 60 degs. is found to give the most useful range of wheels; namely, from a minimum of 15 teeth to a maximum of 120 teeth. The explanation of this is as follows:—

The minimum number of teeth is fixed by the shape of the teeth, and by the impact of the link in coming into gear with the teeth. It is obvious that if a 60 degs. face angle is used, the flanks of a tooth in a pinion having 12 teeth will be parallel to each other and to the radius passing through the centre of the tooth. Fifteen teeth have been selected as the minimum, because on such a wheel the teeth, while not undercut, are sufficiently thicker at the root than at the top to satisfy the requirements of good design.

Experience shows, however, that it is inadvisable, if it can be avoided, to use even so few teeth as fifteen, especially at high speeds. It has been observed that silent chains running on such small wheels, at high speeds, wear out rather rapidly, and this is probably due to the fact that the impact between the links and the tooth faces at entering has a damaging effect on the bearings.

For these reasons, then, it is advisable that where the linear speed of the chain will exceed 1,000 ft. per minute, there should be not less than 17 teeth in the pinion, and 19 teeth will give a quieter drive and greater durability. This, of course, is assuming that the face angle is 60 degs. If the face angle be greater than 60 degs., a satisfactory tooth form, from a design point of view, can evidently be obtained on a pinion with a smaller number of teeth than fifteen, but the considerations of impact, above referred to, would preclude the use of pinions having a smaller number of teeth.

On the other hand, with a face angle of less than 60 degs. the minimum number of teeth in the pinion, from a design point of view, will be greater; but then another consideration comes into operation; namely, the maximum number of teeth that it is desirable to use in any drive. This maximum is fixed by considerations of an entirely different character, which will be dealt with presently, at 120 teeth. If, then, a more acute angle be used between the working faces of the link and the pinion thus obtained have a larger number of teeth, we shall probably obtain rather quieter running, but the magnitude of the speed ratio possible between the driver and driven shafts will be reduced.

With regard to the maximum number of teeth that can be used in the other wheel, it has already been stated that the life of the chain is limited by the difference between the radii of the pitch circles on which the chain runs, when it is new, and when it is just on the point of riding over the tops of the teeth. This difference depends, as far as conditions external to the chain are concerned, upon the depth of the teeth. The depth of the teeth, to all intents and purposes, is independent of the number of the teeth. The considerations that fix it will be indicated later, but the angle between corresponding faces of adjacent teeth depends only on the number of teeth in the wheel. In figures it is 360 degs. divided by the number of teeth.

It is found that with the depths of teeth generally used, a chain that has its pitch extended by 2 per cent. will just begin to ride over the tops of the teeth in running on a wheel having 120 teeth, and 2 per cent. extension of pitch is a convenient figure to fix upon, from the point of view of chain condition. It is, therefore, not desirable to use a wheel having more than 120 teeth under ordinary conditions.

Tangency Circle.

Each of the working faces of a link is at the same distance from the centre of the adjacent bearing—that is, they are tangential to two equal circles described about the bearing centres. Each pin or stud is common to the links of the two pitches that it connects, and, therefore, the corresponding tangency circle of these links coincide. It follows that the working faces of the connecting links are tangents of the same circle, and, as these working faces lie on adjacent wheel teeth, the latter are also equi-distant from the pin centres.

It will be obvious, then, that the effect of increasing the radius of the tangency circle will be to increase the size of the links, and reduce the size of the teeth. At the same time, as the size of the teeth is reduced it is necessary, for the sake of strength, to limit the height to which the chain can climb in adjusting itself for increase in pitch, and this, in turn, limits the life of the chain. On the other hand, a reduction in the radius of the tangency circle will affect the design of the pin, and a compromise is, therefore, necessary.

Assuming that in our link design the pitch, the angle between the working faces, and the radius of the tangency circle are fixed, it is possible to complete the shape of the link.

In the first place, the throat must be sufficiently high to clear the tops of the teeth under any condition that might occur. The depth of the throat will also have its own effect upon the elasticity of the chain. If it extends considerably higher than the line connecting the centres of the bearings, obviously the chain will be very elastic, and this property of elasticity is sometimes a valuable one, making for softness and smoothness of running, as well as silence and efficiency.

In the second place, the inner face of the link must be at such an angle that it can under no condition, either entering or leaving, come into contact with the teeth. It has been found by experiment that under reasonable conditions there will not be a backward bend of the chain, on entering or leaving the wheel, greater than 15 degs., so that the inner faces of the links can be designed with this in view.

That portion of the outer edge of the link contiguous to the working faces must be of such a curvature that with the same backward bending it also will clear the teeth—that is, it must fall entirely within the tangency circle. The back of the link must be decided in conjunction with the shape of the throat, because in certain circumstances it is this that will fix the strength of the link.

The Bearing Feature.

The bearings should be designed entirely from a durability point of view. It is obvious from the remarks that have been made on the subject of efficiency that the difference between the most efficient and the least efficient design of bearing, or, in other words, the design of bearing that gives the least and the most friction, is very small, amounting to something less than half of 1 per cent. of the power transmitted. The expression that this consideration has been given by different makers is shown in the different types of bearing that have been used, and a brief description of these will be of interest.

Plain Bearing.

In the first form of silent chain, the links were punched from steel strip, and hardened, and the studs were plain circular pins. This is the most obvious kind of bearing to use, and naturally efforts immediately began to be made to improve it. It is interesting to note, however, that some chain drives made with this type of bearing lasted as long as fifteen years, so that it must not be too readily assumed that it was a bad one.

Bushed Bearing.

The next type of bearing was what is known as the bush type. Glass hard steel bushes were forced into the links, each bush connecting two, or sometimes three, plates. The pin was a plain steel pin, case-hardened. This type is still used by one firm entirely, and by another for the smaller sizes of chains—that is, from ⅝-in. pitch downwards.

Multiple Block Chain.

The firm that originated the bush type of bearing found it very difficult to obtain the required degree of accuracy when two or more flat plates were strung together on the same bush, and it was not found possible at the time to punch the links from material heavy enough to make them from a single plate, and so another design was adopted. Steel bars were obtained, cold drawn, to the required section, and the chain was made up of blocks, sawn from these bars and case-hardened, the pins still being plain pins of mild steel, case-hardened.

In this design special attention was paid, for the first time, to lubrication in the bearings. Slots were cut in the links, giving access to the pin-holes from the inside, and oil grooves were turned on the pins. This type of chain is very expensive, but exceedingly durable. Some drives that were fitted as long as fifteen years ago are still running with the first chains, showing few signs of wear. Each of the above-mentioned designs were originated by the firm that obtained the first patent for silent chain gearing; namely, Hans Renold, Ltd., and made by them.

Training the College Man for Railroad Service*

By John S. Hall **

Despite the fact of its being abundantly apparent from the contents of the accompanying paper, that the author is an enthusiast in his chosen calling, there is no attempt made, except by appeal to reason, to show that College training, combined with an Apprenticeship System is accomplishing other than the ideal set by those responsible for putting the scheme into effect. The paper is timely and will do much towards popularizing professional railroading.

INVESTIGATION shows that there are a number of railroads on this continent and in the Old Country, who consider it sufficiently to their advantage to offer special courses of instruction in practical matters to certain of their present or prospective employees. These courses generally consist of a systematic training in the various branches of the service, with a view of developing the student along broad and comprehensive lines to fit him for responsible positions.

Southern Pacific Railroad.

In the United States, among the best examples so far is the course in railroading operation conducted by the Southern Pacific. It is open to any young man between the ages of twenty-one and thirty, but preference is given, when all other things are equal, first to college or technical school graduates in the employ of the company, second, to men with a common school education in the employ of the company; and third, to college or technical school graduates not in the employ of the company. It is also stated that the company is not under obligation to any of the students to place them in official positions upon completion of the course. The allotment of time and service is as follows:—

Accounting Department	4 months.
Master Mechanic's Office	6 months.
Maintenance of Way	9 months.
Road Service	5 months.
Stores Department	2 months.
Signal Engineer's Office	2 months.
Station Service	6 months.
Train Master	8 months.

This makes the length of the course three years and six months. A booklet is also placed in the hands of each man, outlining the particular points he should observe during the different periods, together with a carefully drawn-up list of reading and references.

Great Central Railroad (Eng.).

In England, the Great Central has a plan very similar to that of the Southern Pacific. They allow, however, only a certain number of their high-grade clerks who display marked intelligence and ability to take advantage of its privileges.

Three years and six months is also the time divided among the various departments, as shown:—

Engineering Department	6 months.
General Manager's Office	6 months.
Goods Department	6 months.
Locomotive Department	6 months.
Marine Department	6 months.
Rolling Stock Department	3 months.
Stores Department	3 months.
Traffic Department	6 months.

Upon each change every student makes out a report of the experience he has just gained, the best of which are published, with comments by the general manager.

*From a paper read on February 10 before the Canadian Railway Club, Montreal.

**Student in the Department of Railways, McGill University, Montreal.

Canadian Pacific Railroad.

Here in Canada, the C.P.R. has a special apprenticeship course for transportation. Students spend two years and nine months, of which the first three periods of three months each are put in during the three summer vacations, leaving but two years for apprentice work after graduation. They divide the time as outlined below:—

Vacation.

1st Year—Shops	3 months.
2nd Year—Roundhouse	3 months.
3rd Year—Road Service	3 months.

After Graduation.

Station Service	3 months.
Stores Department	3 months.
Master Mechanic's Office	3 months.
Track Work	6 months.
Accounting Department	3 months.
Train Master	6 months.

Special report forms are filled out for each period, and the whole carefully kept on another special record form by the official in charge of the students in the general manager's office. The foregoing covers mainly what has been done, so far, in the matter of apprenticeship in departments other than the mechanical.

The Apprenticeship Question.

Turning to the motive power department, an examination of the Convention reports of the Master Mechanics' Association and of the proceedings of various railway clubs discloses a great deal of divergent opinion on this much vexed question of apprenticeship. As far back as 1896 the college student as a special apprentice has variously engaged the attention of the master mechanics. We find that as an apprentice of the mechanical department he has come in for a lot of adverse criticism, mingled, sometimes, with a certain amount of praise.

The principal charge most people had against him was that he did not have enough practical experience. Others said he thought he knew too much; that he was on personal supposition intellectually much above those who were around him. It was also claimed that he did not have a sufficiently intimate knowledge of the men in the ranks. Our good friend, Colonel Lacey Johnson, in a discussion at the 1904 convention, struck perhaps a far truer note when he said: "We expect too much from the special apprentice, and he expects too much from us." Again, in 1905, when Mr. G. M. Basford, then editor of the "American Engineer and Railroad Journal," in a paper entitled "The Technical Education of Railway Employees — the Men of the Future," before the Convention, stated that special training is fundamentally wrong, but said later on that it probably would be necessary to continue the system of special apprentices for a time.

Leaving the Master Mechanics' proceedings, let us have a look at the report of the December, 1902, meeting of the North-West Railway Club. They were talking of what a special apprentice should do, how long he should do it, and what he should get for doing it, when one man from the Chicago and Great Western who started life—so he said—in the early eighties at five cents per hour, arose and said he envied the high wage they were talking of giving to the special apprentice—it was about eight or nine cents an hour. In other words, the unfortunate apprentice was accused of being overpaid. On the other hand, we have Mr. L. H. Turner, who was superintendent of motive power of the Pittsburgh and Lake Erie Railroad, at the time he spoke before the Pittsburgh Club in May, 1909, reported as saying that the special apprenticeship has not gone far enough.

Taking up the February, 1904, number of the "American Engineer and Railroad Journal," we see there that Mr. R. D. Smith, who was superintendent of motive power of one of the New England lines, said the man who has risen from the ranks understands his men better, and that the special apprentice is favored to the detriment of the rest of the shop; while someone else wanted to know why a college man should not be as competent as a roundhouse foreman; and a third ventured the remark that one reason why college men left the railroads was that they could get quicker advancement elsewhere.

Turning to the July, 1913, issue of the same periodical—now known as "The Mechanical Edition of the Railway Age Gazette"—we have Mr. Basford, in an address before the Casino Technical Night School in East Pittsburgh, reported as saying that it is possible to get a degree at college without thinking, and that most students do not know what they want, and most professors equally do not know what to give them. Again, in the October number, we find the question: "Why Don't Railroads Hold the College Man?" and a very good answer to the effect that the apprenticeship courses are generally too long and the pay too low. This man suggested the remedy of a two-year course with adequate pay.

Mr. D. C. Buell, in the November issue of the above-mentioned magazine, supports Mr. Basford's remark in that the majority of college men do not know what they want, and also adds that most of the college men he has handled do not know much about primary railroading, but he has observed that when a college man knows what he wants he can generally get it on a railroad.

Looking over our extracts and quotations collectively, we observe one thing clearly, which is, that the subject has mainly been discussed by mechanical department officials. The question now arises: May we not equally well apply these criticisms to apprenticeship in departments other than the mechanical? It is not impossible to think that the same remarks or suggestions cannot be applied to all. Are not the failings and the faults the same in principle?

Special Training Proving Its Worth.

Mr. Basford has given us to understand that he considers specially-privileged training fundamentally wrong, but when we see three large and representative railway systems building up and encouraging such special training, we feel that there must, at least, be a little good in it. No railway—or other kind of a business, for that matter—is going to do a lot of work and spend a lot of money without expecting a fair return on their investment. Take the special case of the Canadian course. You all probably know that it was the result of a great deal of labor upon the part of some of the most prominent railway men in the country, and they would not have been anxious to devote their valuable time to it unless they saw something ahead. The same thing can be said, too, of the other systems enumerated before. Again, when he says that most college professors do not know what to give their students, we refute that remark by pointing to the teaching staff of the Department of Railways at McGill. Every railroad subject is handled by a practical railway man.

Practical Experience Feature.

One of the dominant notes which has been sustained so far is "Practical Experience." We hear one man saying that he can learn all there is to learn in a shop in two years, while a recent writer in the "Railroad Age Gazette" considers it the height of egotism for any man—be he who he may—to make an assertion like that. We feel like telling a little story here.

A man, who is now a well-known university professor, was once looking for a job. His friends had told him he was a fine workman, and could probably handle a file with anybody. So he called in on the manager of a tap and die shop one day and made request for a position as foreman. He said he was a pretty fair machinist and produced a tap—quite like those made in the shop—to prove it. The manager said: "Young fellow, it matters very little to me whether you can personally do the work or not, but what I want to know is this: Can you make one thousand men perform that operation to our advantage?"

Now the writer appreciates fully the

fact that it would be pretty hard to tell a man to do something unless, beforehand, he had had some sort of an idea himself. He knows, however, the longer he stayed on a job the more he learned, and he also knows that he could go back to the shop or the roundhouse now, and learn more in three weeks than he did at first in three months; therefore, the vexing question of practical experience for special apprentices naturally turns on the query: "What is the right length of time to put in?" The Canadian Pacific-McGill University answer is "two years after graduation."

Long Apprenticeship Undesirable.

One cannot overlook, in this connection, that exacting too long an apprenticeship may defeat the object in view, since the engineering profession to-day offers too many temptations in the way of salaries to the graduates of technical colleges. Take a typical example:

A certain student has just graduated. He has busily applied himself for four long years in relieving his poor old father of the burden of superfluous cash. This fellow is just an ordinary human being, so he feels that it is about time he started to pay back a little of the money, or at least, to support himself. He hesitates to spend three or more years at a barely living wage, so naturally conditions have to be modified to meet this state of affairs, for unless there is sufficient inducement he will go elsewhere.

Along certain lines the remuneration offered to engineering graduates each year is surprisingly large, and this state of affairs has been realized here by the commendable reduction of the after-graduation apprenticeship to two years, as against the three and a half years' time required by other roads; also, by the fixing of a living minimum wage during the first divisions of the course.

Primary Railroading.

It has been seen before that Mr. D. C. Buell's opinion of the college man is that he does not know much about primary railroading. When a man starts out as a freshman, we agree to this statement. But what is "Primary Railroading?" Is a knowledge of it acquired by having the boss come around just as you are washing up early on a Saturday afternoon, in order to see the ball game, and tell you that one of the gaskets on the 1084 driving-brake cylinders is blown out, so that instead of eating peanuts and drinking pop, you spend the time till the night gang comes on, doubled up in a knot between the frames with a couple of sacks over your shoulders to keep the heat from warping your spine? Or would this knowledge be promoted by being called after two hours' rest to keep the 2796 hot, with a full-tonnage train behind her, over an eighteen-hour hilly division? If it is to be so interpreted, we can answer with full fervor, that "Primary Railroading" is one of the mainstays of our experience, and, that far from being a matter of discomfiture, we count its delightful uncertainties amongst its greatest attractions.

Favoring the College Man.

Someone has been quoted as saying that the college man has not an intimate enough knowledge of the men in the ranks, and that when he is in the ranks he is favored to the detriment of the other apprentices. It must be admitted, that, at first, the college man does not have the desirable knowledge of his fellow-workers so essential to success, but, it is just this failing which a rational apprentice course is expected to correct. The man is brought right into contact with the actual condition, and what is more, he is generally placed in this position at a time when it is likely to impress him most. Of course, getting back to first principles, everything depends upon the man himself. The mistake—and mistake it is—of favoring the special apprentice to the detriment of the rest of the shop has fortunately been avoided here. The company would not be so foolish, and the student himself is carefully warned to avoid it.

A Thinking Course.

We dislike to be constantly referring to a few individuals, but there is another statement of Mr. Basford's, which we wish to take up. He said that a degree could be got without thinking.

We cannot, with justice to ourselves, agree that a man can, without thinking, complete the Railway Course at McGill University together with the apprenticeship training of the Canadian Pacific. Where conditions are such, that even a freshman can obtain seventy-five or ninety dollars a month, on some such employment as inspecting paint or the like during the summer holidays, it requires no little thought and courage on the part of the student to enter a career which demands so rigorous a training with so few immediate returns. He has had ample opportunities for serious reflection throughout the earlier stages of his experiences, and only a fixedness of purpose would endure the ridicule of his better-paid associates.

That is why we term our work a "thinking course." It may be true elsewhere, or perhaps only in Montreal, but there is absolutely no doubt that when a student enters railway work he has thought so much about it, and its future, that he is there to stay, and to develop his best.

Unfair Comparison.

There is one thing, however, that appears a little unreasonable, and that is the tendency a great many people have of comparing college graduates immediately with a man, generally older, and who possesses more experience. They ask why are not college men as good as a roundhouse foreman. As a matter of fact there are a number of graduates who have made good as roundhouse foremen, but it seems a little hard to expect a man with little practical experience, to measure up to another, who has been a number of years on the job. Four or five years after graduation should be the time for considering their respective efficiency.

What Colonel Johnson said in 1904, that the student expects too much from the railroad, and the railroad too much from him was unquestionably true. The majority of students now have found out that Mr. Buell was right when saying that college men, if they "know" what they want, can generally get it on a railroad, and they are also alive to the fact of the constantly-increasing considerate treatment they receive.

A Tribute From Experience.

It is now being found that there is very little of that disagreeableness that many past writers said accompanied the special apprentice. Perhaps there was suspicion at first, before the machine had been oiled, so to speak, as to just what a man's object was, but after a little explanation there was generally nothing but an interested and helpful spirit shown the student. Nothing gives the writer more pleasure today than to go back to the scene of his old job and be cordially received on all sides. It has such an encouraging effect on a man, and is extremely conducive towards building up a spirit of loyalty towards the company, and a feeling of respect and regard for the employees. We think that there will be no cases of a student leaving because he thought he was not getting what he wanted or he had not been treated in the right manner.

No college man, if he has truly had regard to himself, will desire to offensively override the opinions of others, but, of course, there are poor college men, just as there are poor railroaders, or poor farmers, but we would ask you to seek out the average individual before passing judgment on the whole class.

Hon. Nathaniel Curry, president of the Canadian Car and Foundry Co., stated last week that there had been material improvement in car-building orders since the several plants of the company had been opened recently. The passenger car departments at the Montreal plants, Senator Curry said, are working to capacity, and the freight car departments at about 40 per cent. Both the passenger and freight car departments at Amherst are working to capacity.

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

A JIG FOR SECOND-HOLE DRILLING.

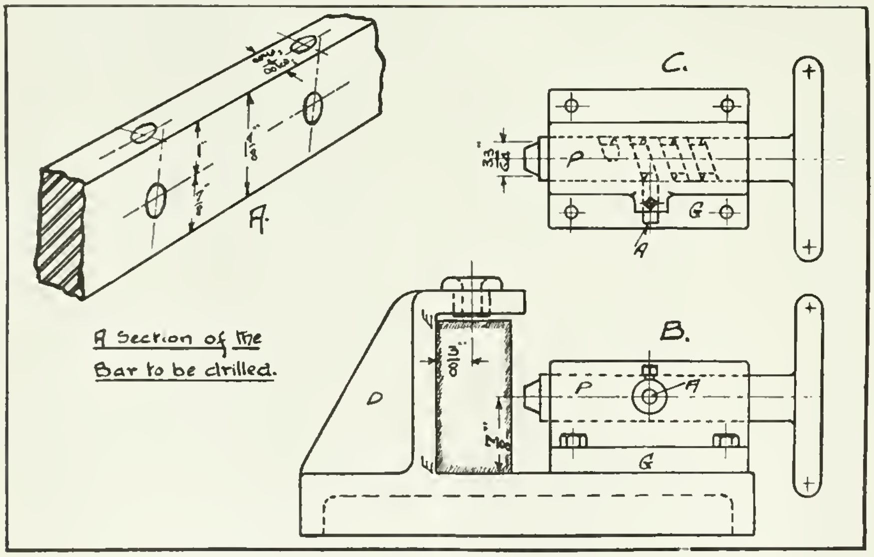
By D. A. Hampson.

SOME TIME ago a drifting proposition presented itself which is best understood by reference to the drawing (A). Steel bars $\frac{3}{4}$-in. x $1\frac{7}{8}$-in. were to be drilled as shown—one $\frac{1}{2}$-in. hole to go clear through the short way, and the other $\frac{1}{2}$-in. hole drilled in the edge and running down to meet the first one. Various lengths of bars were to be drilled and various centre distances were required. Nothing very difficult about that job! No, there is not, except to keep the two matched holes correct and interchangeable with a pair drilled five years hence.

The means employed for keeping the first holes right, and for spacing them, will not be considered. For the second hole, some quick method of indexing, of holding the bars while drilling, yet one of low cost and sure action was required. The jig made for the work is shown at (B), which is an end elevation, and at (C) which is a partial top elevation. The body (D) is of cast iron, 18-in. long, of ribbed section, having a planed floor on which the bars rest, and a right angle side shown by the line (EE) against which they are clamped. A bar in position is shown by the hardened drill is guided by the hardened tool steel tool steel bushing above.

To an extension of the floor is screwed a casting (G) which is equipped with the clamping and indexing mechanism. A 1-in. hole is bored through (G) at $\frac{7}{8}$-in. from the base which is the distance of the first hole from the edge of the bar. A plunger (P) is nicely fitted in this hole and is to be turned by the handwheel at the free or outer end. This plunger has a hardened conical end which enters the hole already drilled and on being screwed in, brings the hole immediately under the grinder bushing. The large end of the core is 33-64-in. which still takes care of a bar accurately, even though the drill has been cutting a few thousandths large. In and out movement of the plunger is secured by cutting a square thread near the centre of the plunger and locking the plunger in by the pin (A) which has a flattened end $\frac{1}{8}$-in. wide by $\frac{1}{2}$-in. long entering the 4 pitch thread. For the work it has to do, this thread is not steep enough to slip, and yet it is so fast that a turn, at the most releases and tightens the work.

After drilling one hole, the handwheel is turned backwards, the bar slid along to approximate position for the next hole, from which the pointed screw draws it into exact place for drilling. This threaded core-pointed plunger proved a happy combination of index pin and clamp that for speed and utility utility would be hard to beat.

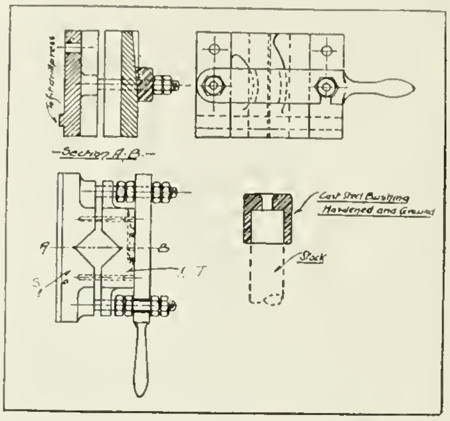


JIG FOR SECOND HOLE DRILLING.

DRILLING MACHINE ATTACHMENT

By J. Davies.

THIS tool was designed by the writer for use in drilling holes in the ends of a lot of cold-rolled shafts. It also makes a very quick and fairly accurate centering device for lathe work. By removing the check nuts and lever, the two pieces which comprise the apparatus can be used as parallel vee blocks for general drilling machine work requiring these.



DRILLING MACHINE ATTACHMENT.

A small casting (S) is made to bolt up against the side of the drilling machine, and if the drilling machine has a round table, with no convenience for bolting work to the side, it will be necessary to get a small angle plate for the purpose.

A tongue or strip is machined on the back of the casting at right angles to the vee, which will automatically set the latter parallel to the drill spindle. Another small casting is made to slide over the first one, with machined vee to correspond. In machining these two pieces the backs are done first. They are then placed on the shaper or planer so that both vees are machined together, otherwise they cannot be used as parallels. Casting (T) is kept in position by two dowel pins, as shown. The work is held by means of the lever, which has a wedge piece riveted on the centre. This bears hard on a corresponding taper on casting (T). The reason that the taper is slightly below the general surface of casting (T) is so as not to interfere with its use along with casting (S) as a pair of parallels.

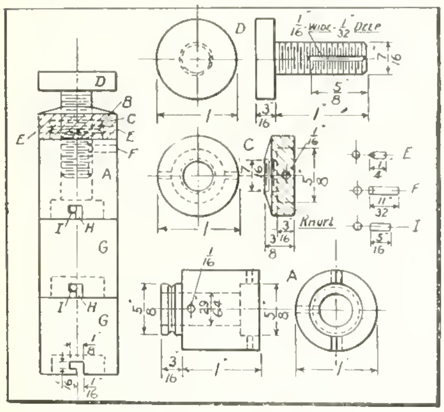
The tension on the lever is adjusted by the check nuts to suit different sizes of bars. The range of the adjustability of the apparatus could be considerably increased by inserting false pieces into the vee. The piece to be drilled is dropped into the jig, and one yank of the lever securely fastens it parallel to the drill spindle. The hardened steel bush is placed on the end and the piece is drilled.

The removal of one piece and setting up of another can be done in a fraction of the time that would be required to do the same operation in an ordinary lathe chuck, and, if the hardened bush is carefully made the work will be more accurate than if done on lathe. A skilled operator is not required, and the lathe is at liberty for more important work.

JACK WITH EXTENSIONS.

By J. E. Cooley.

A SIMPLE design of a jack and extensions used mostly for drill-press work is shown in the accompanying sketch. The base, (A), Fig. 1, is made



EXTENSION JACK.

of cold-rolled stock and has one end turned up, on which is cut a small groove at (B). A knurled nut (C), containing the adjusting screw (D), is placed on the base and held in position by two pins, (E), which are driven in, one on each side of (C), the point of the pins entering the groove (B). A pin (F), is also driven in the base (A). This enters the groove in the adjusting screw and prevents it from turning. Turning the knurled nut, (C), raises and lowers the adjusting screw (D). The extensions (GG) have a pin (H) put on the small end which locks in the slot (I), as shown. There is also a pin and slot on the opposite side of the extension. The parts of the jack and extension are shown in detail and require no extended description. They are made of cold-rolled stock. The knurled nut (C) is beveled as shown, so that the chips will fall away from the screw.

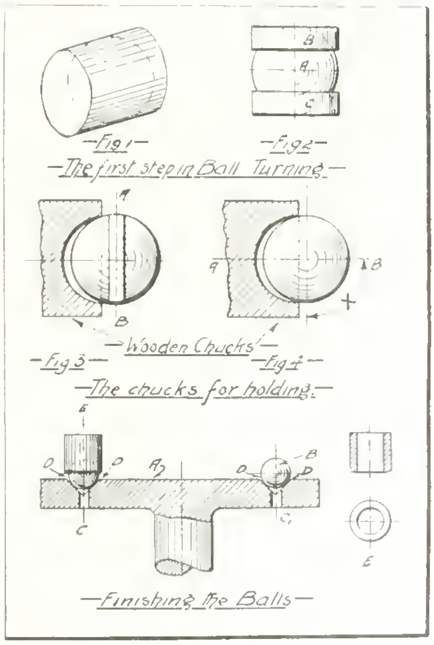
TURNING BILLIARD BALLS.

By A. V. Francis.

THE average mechanic has probably speculated on the methods pursued in the turning of billiard balls, and to those not familiar with these methods the accompanying article and illustrations will probably be of interest.

In general, these balls are chucked in a wooden chuck. The ivory tusk is cut in blocks as shown in Fig. 1. These are chucked in a special machine which cuts a fairly good ball (A) out of the centre, and leaves two rings (B) and (C) at the end which are finished to use as harness rings, Fig. 2. The machine-made ball is then chucked in a wooden chuck, shown in section, by Fig. 3. The ball will hold quite securely before its centre is flush with the face of the chuck. A light cut with a scraper is then taken at (AB), and the ball is changed so that the points (AB) are in the position shown in Fig. 4. The outer line shows the original size of the ball, and the inner one the scrape that has been taken on (AB). Now, if the turner will carefully follow the arc (X) and cut down to the inner line for the surface of the part which has been scraped it is obvious that he will have finished half the ball to a true hemisphere. He then takes the ball out of the chuck, turns it around 180 degrees and finishes the other half in the same way. Some billiard ball turners turn a ring like (AB) and then turn another ring at right angles to the first; then another at right angles to the second, and so on until the job is done. All these operations are done with hand tools.

A ball slide rest can be made by mounting an ordinary slide rest on a central stud and having a worm and wormwheel to give the circular motion. If the balls are made in large quantities and only a few sizes, a tool can be made



TURNING BILLIARD BALLS.

for each size which will produce uniform work and accurate results. The face-plate (A) is of wood or iron covered with wood. In it is turned the V groove (B) with openings (C), so that the turnings from the balls can be easily removed. Strips of leather cemented to the wood so as to give a bite to make the ball rotate, are shown at (D).

The tool is made of steel hardened and ground internally the size of the ball. The balls are placed one at a time on the runway and the tool is put on top. The face-plate being set in motion, the ball rotates and is scraped round by the tool (E), and as soon as the ball reaches the size of the ring it goes inside and the cutting ceases. With composition balls the operation should be very simple as these can be moulded pretty nearly to finished size.

Personal

J. H. Plummer, president of the Dominion Steel Corporation, was in New York last week.

E. W. Knight, manager of Frankel Bros., metal dealers, Toronto, returned this week from a holiday in England.

John W. Fraser, superintendent of the open hearth department, Nova Scotia Steel and Coal Co., has resigned.

A. R. Williams was in Montreal early this week, attending a directors' meeting of Williams & Wilson, Ltd.

W. H. Young, Winnipeg manager for the A. R. Williams Machinery Co., will be in Toronto this week to confer with officials at the head office.

J. H. Henley has been appointed manager of the Safe Department of the Canadian Fairbanks-Morse Co., Ltd., Toronto He was formerly connected with the Winnipeg house.

F. C. Brunke, manager of the United States Steel Products Co., Toronto, was in New York this week, and met Mr. J. Farrell, president of the United States Steel Corporation.

William Brown has been appointed resident representative in St. Catharines, Ont., for the Canadian Fairbanks-Morse Co., Ltd. He will watch out for the Welland Canal trade.

H. K. Clark, machinery salesman for the General Supply Co., Toronto, has severed his connection with that firm, and is now connected with the Wilt Twist Drill Co., Walkerville, Ont.

W. Furniss Clarke has resigned his position as manager of Geo. Anderson & Co., of Canada, Ltd., having accepted an appointment as general superintendent with Armstrong-Whitworth of Canada, Ltd. The appointment is effective March 1st, and on February 28 Mr. Clarke is leaving for England to spend some time visiting the plants of the parent company.

TAKING CARE OF HIGH GRADE HELP.

By C. T. R.

THE question of taking care of high-grade help in small towns is one that has bothered countless firms throughout Canada and the United States. The better class of workmen, men who are competent mechanics, and know they are such, feel that they have a right to be well housed and entertained. If conditions in the town or small city are such that decent rooms and good quality board cannot be obtained, and, if there is no place of high-class amusement where they can be entertained without loss of self-respect, you can figure that it will be but a short time before they will move on to a city that furnishes what that town lacks.

Windsor, Vermont, is a small town with but one industry, the manufacture of Gridley Automatics. High-grade mechanics are employed exclusively, good wages are paid, but, until, recently it has been almost impossible for the management of the Windsor Machine Company to keep their help beyond a certain length of time. Private families, who took boarders as an "accommodation," and restaurants who openly took them for profit, furnished an indifferent grade of board at rates which did not correspond with the quality. The men demanded more than this, and not being able to obtain it, went elsewhere. There was, also, no gathering place except street corners. Time hung heavy on men's hands, and discontent was evident at all times.

Well into the winter of 1912, a few of the most enterprising townspeople, backed by the Windsor Machine Company, formed the Windsor Club. As no other building was available at that time, the old shop, formerly occupied by the machine company was remodeled at comparatively small expense, into one of the most interesting and progressive club rooms of New England. Four hundred members were enrolled, and after nine months of successful operation, the register shows approximately the same number of paid members. The membership fee was fixed at five dollars a year, payable quarterly in advance, and a small fee has been charged for the use of the bowling alleys, billiard and pocket billiard tables and the shower baths. These charges have placed the club on a self-supporting basis.

BOWLING ALLEY FEATURE.

Men without homes gather here for their evening's amusement, and Wednesday night of each week sees the dance floor, which is 100 feet by 50 feet, and probably the best in the State, covered with an orderly and pleasant company of the members and their friends. The employees of the company meet the management under circumstances that further a better acquaintanceship, and with this better understanding, are capable of developing into better workmen and better citizens.

After seeing the club well started, it was impressed more firmly than ever upon the manufacturing company that better eating and sleeping accommodations would have to be provided for the men who were becoming more valuable each day. There was plenty of room left in the old factory building to install a modern restaurant with sleeping rooms attached, and work was commenced early in the summer of 1913, on remodeling the building. Oil-soaked floors were torn up and replaced with a good grade of hard wood; partitions divided one long shop department into twenty-five sleeping rooms—four of these with bath connection—and in a very short time a model restaurant was fully equipped to supply the needs of both employees of the company and transients.

An old planer room was converted into a perfectly equipped kitchen having every convenience that could be purchased—refrigerator, 12 ft. by 24 ft.; steam tables, dish washing machine, electric potato parer, and many labor-saving devices that enable the best service to be

RECREATION HALL FEATURE.

obtained. Artificial refrigeration is used, together with artificial ice for the table.

When the machine company moved to their new and up-to-date plant in 1910, they left their engine, boilers and dynamos in the old factory. These have been put to use in furnishing light, heat and power for the "Windsor Club" and "Windsor Club Dining Room," thus reducing this expense to a minimum.

The results of the whole investment are proving satisfactory in every way to the Windsor Machine Co. Men do better work when well fed, they are content to stay in a town which furnishes good clean amusement and recreation outside of working hours, and there is a closer application to and interest in their work than has ever been noted in the past.

Manufacturers are realizing more and more that it is necessary to take an interest in their employees after the shop doors close at night, and there are more firms than one who would do well to convert some old unused building into a recreation hall for their employees.

Trade Gossip

The Canadian Dredging Co., Ltd., has increased its capital from $750,000 to $1,500,000.

The Goldie & McCulloch plant, at Galt, narrowly escaped destruction on Friday last when a fire destroyed the adjacent plant of the Shurly-Dietrich Co., Limited.

The Renfrew Machinery Co.'s traveling salesmen and agents were guests of the company at the fourth successive banquet given in Renfrew, on Wednesday, Feb. 4.

D. McKenzie, Guelph, Ont., maker of hack saws, bench drills, engine lathes, shapers, etc., is now doing business under the name of the D. McKenzie Machinery Co.

The Provincial Boiler Inspection Department, Toronto, will send a man to Pittsburgh to inspect 25 boilers which a sub-contractor will bring in for use on the new Welland Canal.

Steffens & Noelle Aktiengesellschaft, a German company, has been authorized to trade in bar iron, hoop iron and shaped iron sheets, and plates, mild steel girders, etc., in Ontario; Samuel King, Toronto, attorney.

Carbic, Ltd., Toronto, have recently supplied a 75-ft. capacity portable oxy-acetylene welding plant to the Toronto Street Railway, and a 150-ft. capacity plant to the Dominion Dredging Co., Port Dalhousie, Ont., the latter being for work on the new Welland Canal.

N. S. Steel Output. — The output of the Nova Scotia Steel & Coal Co. for the month of January shows coal mined, 60,600 tons; pig iron made, 5,900 tons; steel made, 77,000 tons; ore mined, 43,000 tons.

The National Steel Car Co. first annual report, issued on Monday, showed net profits of $157,153 after deducting $86,074 for renewals and repairs made during the year. Sufficient orders are on the books to enable the works to be operated without interruption until late in the spring of 1914.

Duty on Implements.—There is a well-defined rumor in circulation to the effect that the Government has in view a reduction of the duties on agricultural implements. It is stated that this will be announced in the coming budget speech. The report is that the reduction will be, perhaps, slightly more than that proposed by the reciprocity agreement, which varied from 2½ to 5 per cent.

Duty Reduced.—The customs authorities at Ottawa have agreed to reduce the amount of duty payable on the plans of Sir John Wolfe Barry for the construction of the second narrows bridge at Vancouver. The cost of the work will be approximately $2,500,000, and duty to the extent of between $5,000 and $6,000 was demanded, but on representations being made this has been reduced by 30 per cent.

Auto Industry Reviving.—The application for space and the great interest already taken in the coming Automobile Show to be held in the Exhibition Grounds, Toronto, from the 14th to the 21st of February is not only an advance indication of the success of the Show, but also of the revived interest in the automobile world. Those qualified to pass an opinion say that prospects were never better than they are this year.

The Theodore Kipp Co., recently opened an office in Winnipeg as mill engineers and general machinery dealers. Mr. Kipp installed all the machinery for the new mill at Moose Jaw for the Robinhood Mill Co., and has had wide experience with general, power plant and milling machinery. The company is well equipped for advising on and carrying out new work and is in a position to supply the necessary machinery, having a number of agencies for various lines, such as Worthington pumps and condensers, International Gas Engine Co.'s products, Foxboro recording instruments, Green chain grate stokers, Richardson-Phenix lubricators, Diesel engines, tubular boilers, concrete chimneys, steam specialties and recording instruments, etc.

The Nova Scotia Car. Co. held its annual meeting on Wednesday, Feb. 4, at Halifax. Reports were presented and officers elected. Dividends were paid on the first preferred stock amounting to $42,574. The president reported business slack for the past three months, but the company increased its earnings 20 per cent. last year, notwithstanding the fact that the plant had been working only about eight and a half months. It is understood that there are orders on hand for about 200 cars. The officers elected were: President, O. E. Smith; vice-president and general-manager, F. N. Brown; directors, J. R. Douglas, F. B. McCurdy, J. R. Lamy, A. M. Bell, E. J. Clayton, G. Fred Pearson and Hector McInnes.

Made In Canada.—"Wherever possible, ships to be used in the Canadian service will be built in Canada." This was the statement of Hon. Mr. Hazen made on Tuesday, Feb. 3, during the discussion of marine department estimates and the policy was heartily approved by members on both sides. "My policy," said Mr. Hazen, "is to have all vessels possible built in Canada. In calling for tenders to-day we are insisting that vessels for the marine department must be built in this country. There is no protection for shipbuilding in Canada and the rate of wages is lower in Great Britain than in this country. Canadian shipbuilders are at a disadvantage. Two ships are being built for us at a Western Ontario shipbuilding plant, that of Collingwood, and tenders for ice-breakers, which have just been issued have a clause that they must be built in Canada."

Farm Machinery Contracts Bill.—When an Act respecting agreements for the sale of farm machinery came up for consideration before the law amendments committee of the Manitoba Legislature, last week, J. B. Hugg, who appeared for the Manufacturers' Association, argued that while the manufacturers or the implement dealers were not opposed to the Bill, they desired that a reasonable and uniform contract should be made which would be binding to vendors and buyers alike. The Bill as proposed, he continued, would work an injustice on the manufacturers of farm machinery as against other manufacturers. He admitted that legislation of the kind sought for in the Act had been to a large extent brought on by the implement dealers themselves by reason of their iron-clad rules which were often impossible. The committee asked that a statutory contract might be drawn up which would extend to goods other than farm machinery.

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

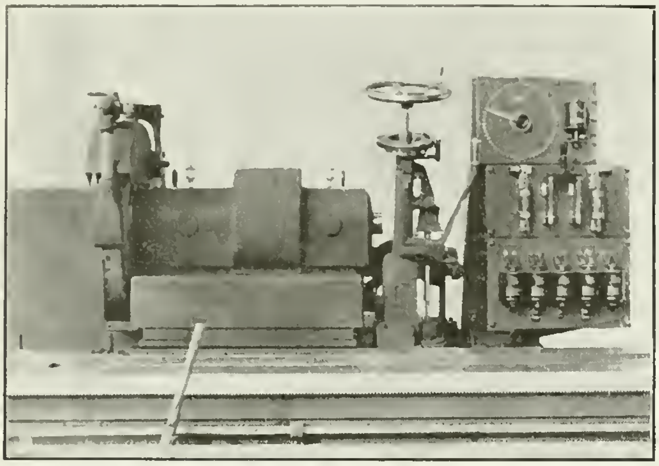
ELECTRICALLY-DRIVEN PLAIN GRINDING MACHINE.

THE accompanying description and illustrations refer to a large electrically-driven plain grinding machine, just completed by the Landis Tool Co., of Waynesboro, Pa. This machine has a range for work 30 inches in diameter and 20 ft. in length. As will be seen, it is driven by three motors; one for the grinding wheel, one for revolving the work and traversing the grinding wheel, and one driving the water pump. The work and traversing motor belts with the gear box at the end of the machine, which is arranged with clutch mechanism so that the drives can be started and stopped independently, or together, independent of the motor. The motor runs at a constant speed, and the speed changes of both the work and wheel traverse are made by an arrangement of gear shifts and clutches, all of which are operated from one position at the front of the machine. There are 16 different work speeds, ranging from 2 to 45 revolutions, and 10 changes of wheel traverse speed, ranging from $2\frac{1}{2}$ in. to 84 in. per minute.

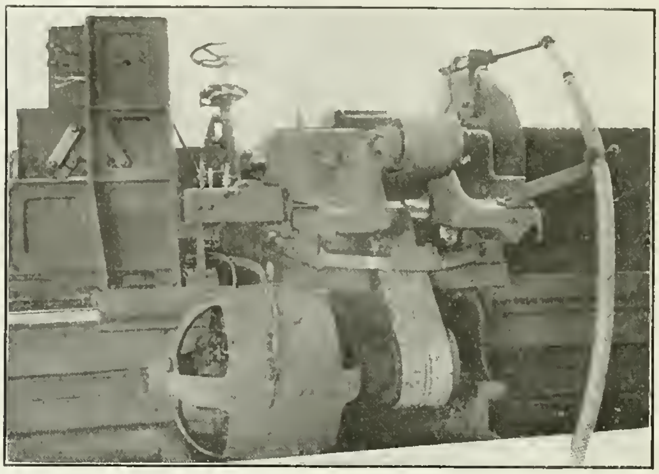
The grinding wheel is driven by a variable speed motor, the speed of which is controlled by the electric apparatus, as shown mounted upon the main wheel carriage. The standard size wheel for this machine is 30 inches in diameter, with a wearing range of 8 inches dia., for which the electric controller is arranged to give the proper cutting or peripheral speed with the wheel at any size within its range of wear.

As will be observed from the rear view, the grinding wheel motor is mounted upon a separate carriage, which travels on a track formed with the base of the machine. These carriages are entirely independent, except for an arm connection for propelling the motor carriage with the traversing movement of the wheel carriage. The motor carriage is mounted on large rollers, which are fitted with ball bearings. The track surfaces upon which this carriage travels, are protected by metal guards. The electric current is transmitted to the wheel motor through sliding contact shoes and feed wires located along the body of the machine. These wires, also, are protected by a shed-form metal guard, to prevent anything from falling on them from directly above.

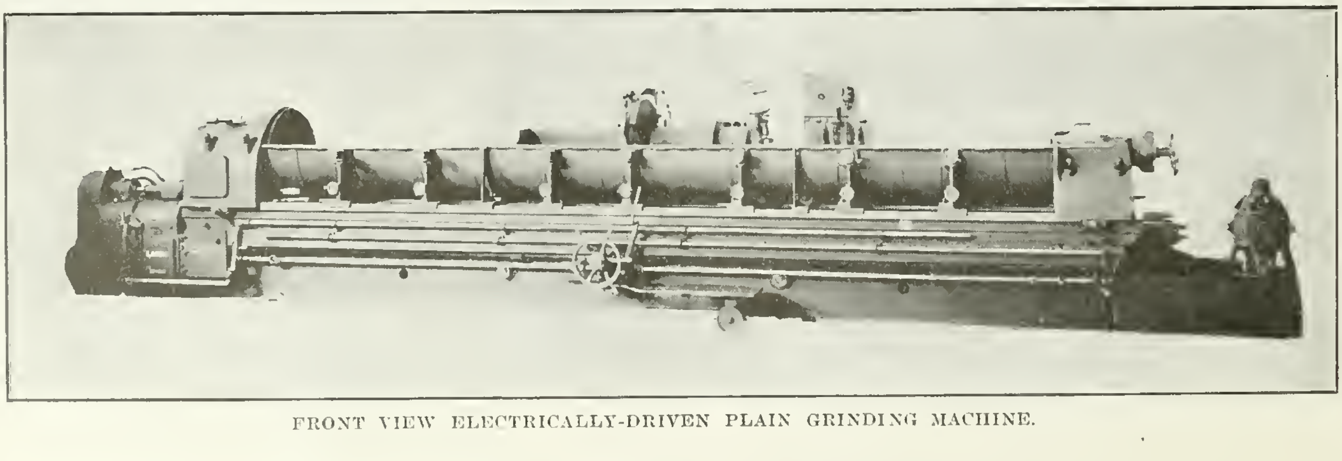
The grinding wheel slide for feeding the wheel to and from the work is arranged with a rapid mechanical feeding mechanism, which is operated by the vertical lever located between the feeding hand wheel and the motor controller. This is clearly shown in the front view, and is for the purpose of moving the wheel away from the work quickly, when changing from piece to piece, or from one size to another, in case of various diameters being ground on the same piece, and for feeding the wheel in quickly to the grinding position. The action is for the transverse feeding movement of the wheel to be in the same direction as the movement of the operating lever. To feed to the work, the lever is pulled in the same direction, and the reverse, when moving away from the work. In addition to this, there is the



FRONT VIEW GRINDING WHEEL HEAD AND ELECTRIC CONTROL APPARATUS.



GRINDING WHEEL DRIVE FROM REAR.



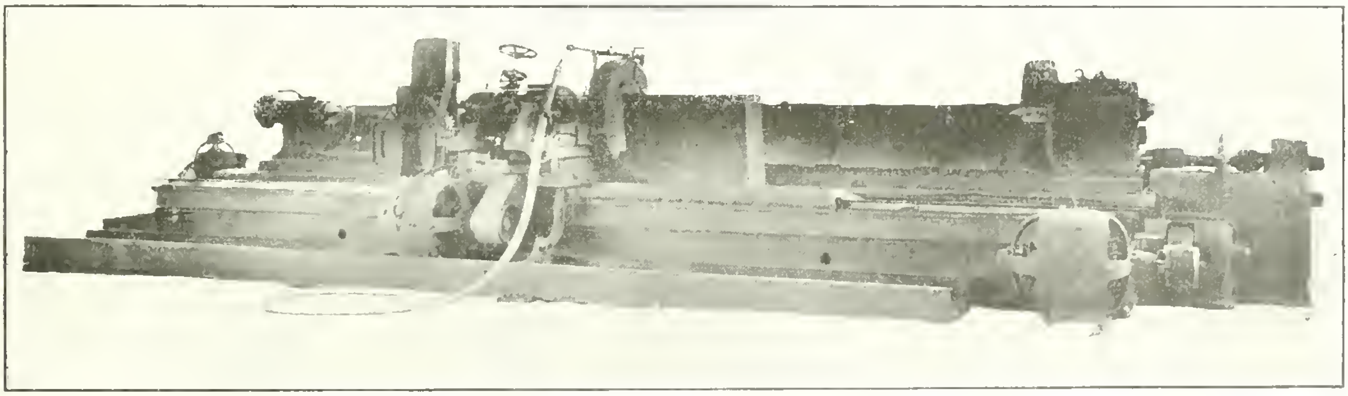
FRONT VIEW ELECTRICALLY-DRIVEN PLAIN GRINDING MACHINE.

usual hand feed, as well as automatic, for feeding the wheel at the reversing points. The grinding wheel motor is controlled by an automatic motor starter and field rheostat, with rheostat relay.

This makes a very efficient arrangement, as the controller can be set to give the wheel the proper peripheral speed for any diameter within its wearing range, and the motor is then operated by an ordinary knife switch. The arrangement gives a positive control of operation, and, with the automatic starter, the speed picks up gradually after the starting switch has been thrown into contact.

A feature in the construction of this machine is that all bearings of spindles which run continuously while the machine is in operation, are, without exception, made of bronze, and the spindles are of hardened and heat-treated steel. The starting box of the water pump motor is mounted directly upon the motor itself, which places it in a very convenient position to the operator. The starter for the work drive and traverse motor is not shown, as this is mounted as may be desired when the machine is installed.

The machine is intended for grinding a line of large shaft work, the largest piece to be handled occupying the full distance between centres, the diameters ranging up to 24 inches. It is strictly a manufacturing grinder, and is, therefore, well suited for other work, such as engine crank shafts, steam turbine shafts, armature shafts, and heavy roll work. The machine is also built for 40 inches swing, when desired.

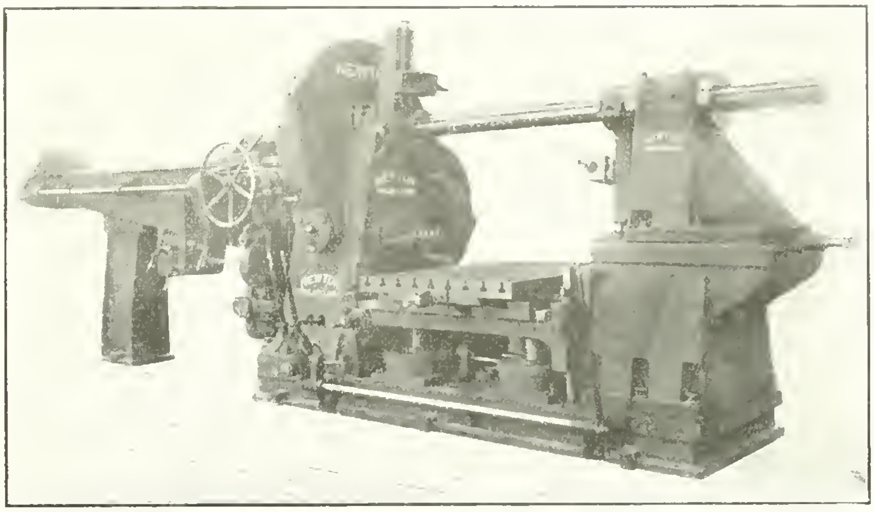


REAR VIEW ELECTRICALLY-DRIVEN PLAIN GRINDING MACHINE.

BORING MACHINES FOR LOCOMOTIVE CYLINDERS.

THE Newton Machine Tool Works, Philadelphia, Pa., have recently designed and built two very large boring machines for the purpose of boring locomotive cylinders, and having the circular valve chambers bored from the solid cylinder casting in the shortest possible time. In order to accomplish this purpose, it was considered that with one setting of the work for all operations, much time formerly wasted would be saved, therefore, the machines were fitted with compound tables having transverse, longitudinal and vertical adjustment, to permit of first boring the circular valve chamber, then the cylinder, so that while the cylinder is being bored, the valve chamber bushing may be fitted, and this bushing finally bored out without disturbing the location of the work on the tables. It will be noted from the ilustration that particular care has been taken to cover the parts that might be dangerous to the operator. The machines were built to the following specifications:

The work tables have four elevating screws. The 7-in. diameter spindle is fitted with double spline, has a continuous travel of 140 inches with six changes of gear feed and rapid power traverse in both directions, giving capacity to bore and finish both ends of cylinders 50 inches long. The cross adjusting table is 54 inches wide by 72 inches long, and the vertical adjustment gives a range of from 39 in. to 51 in. from top of table to centre of spindle. The maximum distance between facing arms is 60 inches. The net weight of the machine is 75,000 pounds. The machine is driven by 20 h.p., General Electric motor, running at 400 to 1,200 r.p.m., giving spindle speeds of from $2\frac{1}{2}$ to $7\frac{1}{2}$ r.p.m. The main drive for the spindle is through a steep lead

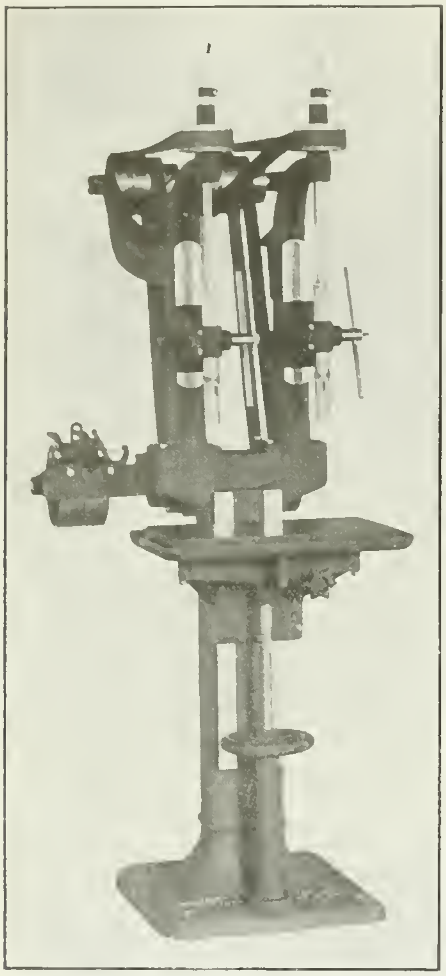


BORING MACHINE FOR LOCOMOTIVE CYLINDERS.

worm wheel having a bronze ring mounted on the spindle sleeve, engaging with a hardened steel worm, fitted with roller thrust bearings, both entirely encased for continuous lubrication; and the drive is so arranged that the fast power traverse feature of the spindle may be used while the spindle is not rotating. This fast power traverse, the rotation of the spindle, and the power elevations on the table may be disengaged or engaged by levers located on the table of the machine, both alongside the main head and the outboard bearing without stopping the motor.

The feed is taken from a gear box having eight gears distributed on a sliding sleeve to give six changes without gear removals, and the sleeves are easily adjusted by means of the latch levers shown. The trolley is mounted on the horn for feeding, while the saddle has roller bearings to take the thrust in both directions, and the feed and fast power traverse is maintained through a rotating screw.

The outboard bearing has independent in and out adjustment, so that the cylinders may be mounted on the main table and adjusted to come within range of the facing head on the main spindle sleeve, the outboard bearing being then adjusted to bring its dependent facing head within range of the adjacent spindle flange. The facing heads, it will be noted, have all the latest features, including eccentric clamp, permitting of rotating the spindle sleeves while the facing heads hang idle without removal, if desired.



MULTIPLE SPINDLE FLOOR DRILL.

MULTIPLE SPINDLE SENSITIVE FLOOR DRILL.

MULTIPLE spindle sensitive drills have always been recognized as an economical means for increasing production and reducing manufacturing costs. They are, therefore, an important factor in modern shop equipment. In designing a new line of multiple spindle drills, The Rockford Lathe & Drill Co., Rockford, Ill., have made a special effort to produce a very simple, accurate, and efficient machine, convenient to operate and of ample weight to handle the rapid production that up-to-date methods demand.

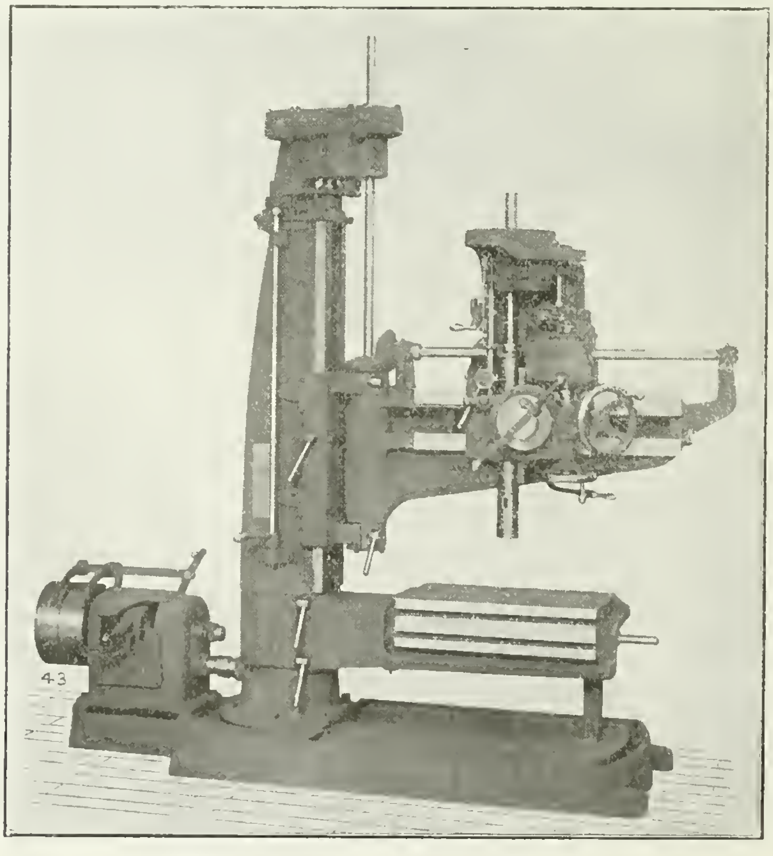
The column of box type, of generous dimensions, with extra wide dovetail slide is well braced and very rigid. The table which is raised and lowered by handwheel has adjustable supports and may be removed for replaning when badly worn. The spindles are of the best quality high carbon steel, forged and ground. They are provided with ball thrust and stop collars and are counterbalanced by weight and chain. Each machine is furnished complete with belt, ready to run as illustrated. They are also built with three and four spindles. The leading dimensions of the Rockford No. 210 "Economy" Floor Drills, being the name by which they are known, is as follows:

Distance from column to centre of spindle, $7\frac{1}{8}$ in.; capacity, $\frac{5}{8}$ in.; greatest distance from spindle to table, 27 in.; distance from centre to centre of spindles, 10 in.; vertical travel of spindle, $5\frac{1}{2}$ in.; vertical adjustment of head, 9 in.; hole in spindle conforms to Morse Taper No. 2; diameter of spindle, $\frac{3}{4}$ in.; size of table, 12 in. x 20 in.; face of cone pulley, $1\frac{5}{8}$ in.; size of tight and loose pulleys, 8 in. x $2\frac{1}{4}$ in.; speed of tight and loose pulleys, 350 r.p.m.; net weight, 655 lbs.

NEW HEAVY DUTY RADIAL.

THE 3-ft. heavy duty box column radial, illustrated herewith, is the latest product of the Fosdick Machine Tool Co., Cincinnati, O., and, with the exception of the column, arm, and table, is the same design as their highly developed round column machines, the first of which was described last August. This machine is particularly adapated to a great variety of work, correct feeds and speeds being instantly available for all sizes from 5-16 inch carbon to 3-inch high speed drills. A very complete metal speed and feed plate is conveniently attached to the column. For heavy drilling or tapping in steel, an oil channel is cast around the base, which drains into a large reservoir under the column where a pump and piping may be attached. For the smaller steel drilling and tapping operations, a liberal channel has ben provided for the table which drains to one corner under which any receptacle for the lubricant may be placed, thus avoiding the use of a pump and return piping.

Special attention is called to the design of the column and arm, the former being of a heavy one-piece box section, internally ribbed; and the latter of the pipe and beam section, which has proven itself a most rigid combination. This construction also permits the long saddle bearing to be securely gibbed to the wide flat face of the column, making sagging of the arm impossible, provides means for taking up any amount of wear, and brings the binder levers up close to the operator. The arm rests on



THREE-FOOT HEAVY DUTY RADIAL DRILL.

a special ball bearing, which reduces the effort required to swing from one position to another to practically nothing, and as the pivoting point is in the saddle close to the work, the arm is very sensitive for exact and rapid setting.

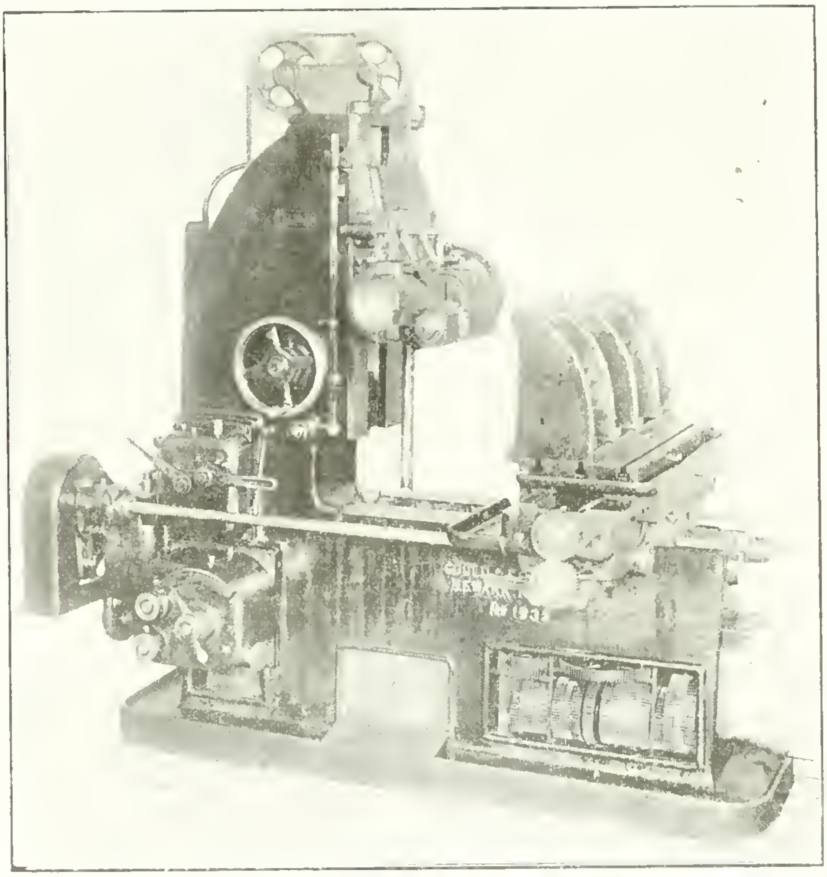
The elevating screw which raises and lowers the arm on the highest speed by power is suspended on a ball bearing, and the handle is placed below for the convenience of the operator. Safety trips for both extremes are provided. The tapping reverse frictions are simple and powerful. They are instantly adjusted for any amount of wear from outside the enclosure in which the gears run in oil. The back gears are on the head, giving three changes with one lever without stopping the machine. They are located between the spindle and the frictions permitting the heaviest kind of work without slipping. Bevel gears are planed theoretically correct, and spur gears are cut with special cutters to insure noiseless running. They are of steel and hardened where necessary. The feed wormwheel runs in oil.

There are five changes of feed all made by a single lever without stopping. The feed box is placed low on the head giving support to both ends of the feed worm. The speed box provides six changes with a single lever, which is secured by a latch to prevent chattering on the heaviest work. A positive overtake keeps the machine running at a reduced speed, avoiding shock when making changes. All gears are thoroughly encased yet easily accessible, and the lubrication system is very complete. Oil chambers or felt wipers are used, as the location requires, and bearings are of special phosphor bronze bushings. Motor drive may be added to the machine at any time without a special base or speed box, and constant speed, or 3 to 1 variable speed motors of 3 to 5 horse-power may be used. They are connected by rawhide gearing. Although the machine is termed a 3-foot radial, the maximum distance from the spindle to the column at the base is 39 inches and between the spindle and the base, 52 inches. The net weight is 4,200 lbs.

NEW AUTOMATIC RACK CUTTING MACHINE.

OF all machine tools, there is possibly less said and written about rack cutting machines than any other tool. The accompanying description and illustration should, therefore, be of more than ordinary interest.

This new machine, designed for medium class work by Gould & Eberhardt, Newark, N.J., is made up of parts of their 36 in. x 12 in. vertical cutting type gear cutter, but in detail has been carried to such a degree of completeness that it is an automatic rack cutter in every sense of the expression. It has many novel features. The vertical cutting principle works out particularly well, permitting a powerful cutter spindle drive without a long over-reaching arm or head, the chips and cutting compound thereby clearing themselves and dropping into the base of the machine. The cutting strains, it is figured, are absorbed in the base.



NEW AUTOMATIC RACK CUTTING MACHINE

The work table indexes automatically, and while the indexing is being performed, the cutter slide is locked so that it cannot feed down until the indexing is complete. Single or gang cutters may be used, and the machine will index automatically according to the number of cutters being used at one time. The work table indexing screw is of high degree accuracy, and a micrometer is provided so that the table with rack being cut can be moved slightly without disturbing the indexing change gears. This makes it possible to cut racks longer than the machine is rated to do, or to cut sections of racks that are to be matched together as one long piece.

The machine will cut racks up to 36 in. long by 10 in. face in one setting, and will cut up to 3 diametral pitch in cast iron and 4 diametral pitch in steel. The indexing mechanism is positive.

There are 16 changes of feed which may be quickly had by means of a very compact feed gear box. There is also a wide range of cutter speeds, and only one belt is required to drive the entire machine. The driving pulley is completely enclosed in a neat guard, and all running gears are also enclosed.

For shops not having enough racks to keep a machine like this busy, an indexing table for cutting either spur gears or spur and bevel gears, is furnished, and as it only takes a few minutes to change this over for cutting either racks, or gears, it makes an ideal machine for manufacturing and for gear jobbing concerns.

A larger machine of this same design is being built which will cut racks up to 72 in. long by 12 in. face, or gears up to 60 in. dia. by 16 in. face. Its pitch capacity is $1\frac{1}{2}$ diametral pitch in cast iron, and 2 diametral pitch in steel.

Toronto, Ont.—Three tenders were received by the Board of Control for the construction of a complete mechanical filtration plant at Toronto Island at an estimated cost of $1,100,000. They were referred to Works Commissioner Harris for his consideration and report. The tenders were: Ver Mehr Machinery Co., England, branch office, Toronto, $1,177,054 for filter with steel container, and $1,096,277 for concrete container; New York Continental Jewel Filter Co., $1,197,580; Pulsometer Engineering Co., London, England, $1,733,463.

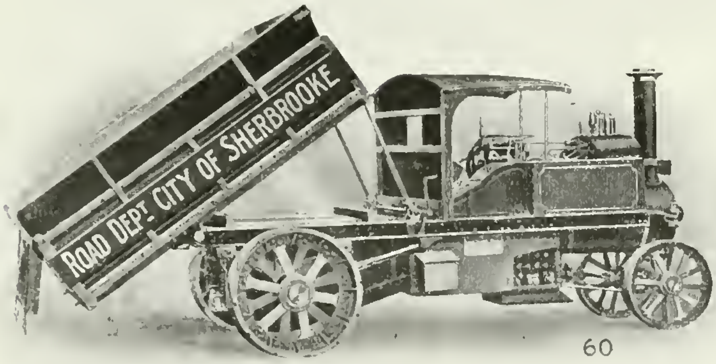
MONTREAL MOTOR TRUCK SHOW.

FOLLOWING a very successful exhibition of pleasure cars held during the previous week, the Montreal Motor Truck Exhibition was opened on February 3, and remained open until February 7. The show was held in the Craig street Drill Hall and about 35 firms were represented. Motor trucks of all types were shown in capacities ranging from 7 tons down to 1 ton or less.

Prominent among the exhibitors were the Canadian Fairbanks-Morse Co., who, in addition to showing motor-boat engines and automobile accessories of every kind, had on view three Mack trucks. One of these, a 3-ton truck sold to the Canadian Consolidated Rubber Co., runs on what are said to be the largest pneumatic tires in the world. They measure 8-in. x 38-in. and are inflated with air at 160 lbs. pressure. They were fitted to this truck largely for the sake of their advertising value. Another Mack exhibit was a 5½-ton power dump truck, one of four sold last summer to the City of Montreal. A full load of crushed stone, gravel or similar material can be dumped from this truck in 11 seconds, the entire operation being controlled by the driver from his seat. The third Mack truck was a very handsome and useful example, recently sold to Warden King, Ltd., Montreal.

John Millen & Son, Ltd., Montreal and Toronto, had an attractive exhibit of accessories such as acetylene head lamps, Columbia dry batteries, Rajah spark plugs, Hoffmann ball bearings, Coventry driving chains, etc.

"FODEN" 5-TON TIPPING STEAM TRUCKS.

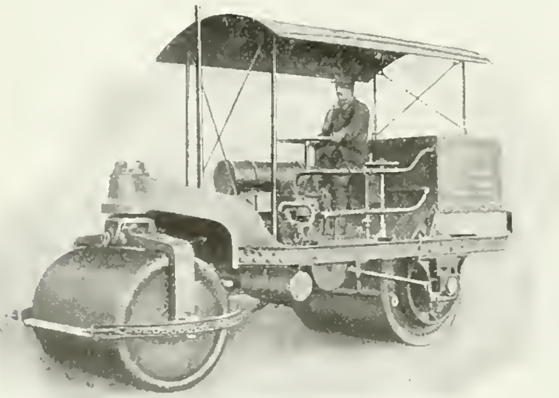


"FODEN" 5-TON STEAM TRUCK.

The Canadian Pneumatic Tool Co., had on view four 1-ton Little Giant trucks of the 1914 model. These are built by the Chicago Pneumatic Tool Co., who state that the present model is a considerable improvement over last year's, the frame having been strengthened and a 4-cylinder engine fitted instead of a 2-cylinder.

The Albion Motor Car Co. of Canada, showed a 2½-ton and a 5-ton chassis, a 1-ton delivery wagon and an 8-ton water ballast road roller. The latter is a particularly compact and well-designed machine and attracted much attention. An interesting feature of the Albion truck is its system of lubrication in which nine pumps give a positive feed of oil to cylinders and bearings in quantities suited to the requirements of each.

Jones & Glassco, Montreal, had on exhibition a large variety of the well-known Renolds silent and roller chains, varying in size from the lightest cycle chains up to roller chains capable of transmitting 80 h.p. They also exhibited the only steam-driven motor trucks in the show. These were two Foden trucks of 6-tons capacity, one being of the dumping and the other of the lorry type. Although so widely used in Europe, steam trucks were only introduced into Canada some three years ago, but have in that time met with much favor in industries where considerable heavy hauling is required.

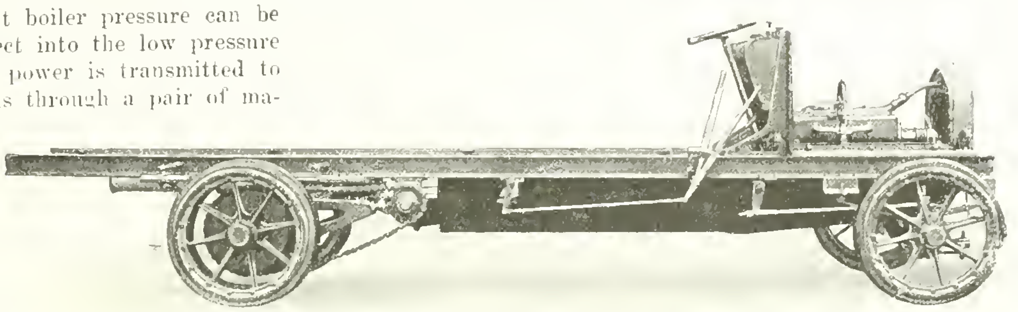


10-TON WATER BALLAST ROAD ROLLER WITH ALBION ENGINE.

ONE OF THE FOUR 5-TON "MACK" TRUCKS SOLD TO CITY OF MONTREAL.

The Foden steam truck has a boiler of

the locomotive type. This forms the front part of the framework, while the sides of the frame are of the usual channel steel, well tied and braced together. The boiler is fired with coke, coal or wood, as desired. The engine has compound cylinders, 4 inches and 6¾ inches in diameter and is mounted on top of the boiler. In cases of emergency, steam at boiler pressure can be introduced direct into the low pressure cylinder. The power is transmitted to the road wheels through a pair of machine-cut spur wheels and an extra strong Renold roller chain. It is claimed that this truck can readily ascend a 14-per cent. grade under full load at slow speed and can travel 40 miles on its own fuel-carrying capacity.



5-TON ALBION CHASSIS.

The Westmount Motor Co. had a good show of Garford 5-ton trucks, and automobiles. Francais exhibited three Berliet trucks which are the same as used in the French army. These were 7-ton trucks capable of hauling a trailer also carrying 7-tons.

Other well-known cars shown were the Pierce-Arrow, the Commer, the Halley, the Packard, etc. The show was well attended and was a great success in every respect.

BURNING COKE OVEN GAS IN O. H. FURNACES.

AN account of recent progress in the construction of rolling mills was object of which is to make it possible to overcome the disadvantages of burning coke oven gas in open-hearth furnaces. The patent covers a regenerative furnace with gas and air ports at each end, and having means of returning burnt gas from one end of the furnace to the gas port at the opposite end, and also means of introducing coke oven gas into the burnt gas. Coke oven gas is light and has a high heat content.

In applying it to open-hearth furnaces, it has a great tendency to rise and pierce the protecting air blanket, causing great damage to the roof. Its flame also has been of an unsatisfactory and uncontrollable nature, so that the heat units were not used to the best advantage, a larger number of heat units per ton of steel being required than with the other more controllable fuels. Attempts to mix it with air at the ports, as in the case of natural gas, have not overcome these difficulties. It burns close to the port, developing a large amount of heat suddenly with a brush-like scattering flame.

The patentee claims to have remedied these difficulties, and to be able to produce in an open-hearth furnace a coke oven gas flame that is thoroughly controllable. This is done by mixing the coke oven gas in the gas ports with the inert and relatively heavy burnt gases of the furnace.

AIR BRAKE TESTS—PENNSYLVANIA RAILROAD.

IMPORTANT improvements in the braking of heavy passenger cars were described in a paper read before The American Society of Mechanical Engineers at the Engineering Building, 29 West 39th street, New York, on February 10, by Mr. S. W. Dudley, of Pittsburgh. These tests were conducted jointly by the Pennsylvania Railroad and the Westinghouse Air Brake Co. The results are considered the most important recent contribution to the subject of air brakes.

A train of 12 steel cars traveling 60 miles per hour stores up 224,000,000 foot-pounds of energy. This is sufficient to raise the entire train 120 feet. With prevailing brake equipment such a train would be stopped by an emergency application in a distance of 1,600 to 2,200 feet, according to the truck rigging and brake shoe design. The tests showed that this distance has actually been reduced to 1,000 ft., or to within the length of the train; the result being due to improvements in the truck brake design, involving the clasp brake, having two shoes per wheel, and the location of the brake shoes with reference to the horizontal centre line of the wheels, in addition to improved methods of applying the air brakes quickly and simultaneously and at a high pressure. This concerns safety.

The tests emphasized, as has never been done before, the possibilities of improvement in efficiency and economy in regular service operation by proper attention to design and installation in order to permit the realization of the flexibility of improved air brake apparatus. The improvements centre in the electric control of the brakes, giving quick, simultaneous and responsive action. The electric control has opened the way for maximum effect in practice of improvements in practically every factor involved in air brake apparatus, all of which were covered in the development represented by the tests. The tests constitute a progressive development of brake rigging and brake shoes in connection with the scientific study of the air brake as a whole.

Trains of 15 years ago were stopped in about half the distance prevailing in the practice of to-day. Increased size and weight of equipment brought an entirely new brake problem, and these tests have solved it to all persons interested.

THIN SHEET ROLLING.

AN American patent has been granted to Thomas S. Blair, of Chicago, the given a short time ago in "Stahl und Eisen." Sheet rolling, and more especially thin sheet rolling, is an operation which formerly required the presence of a skilled workman, because of the variations of diameter which the rolling cylinders suffered by dilatation, variations which finally showed themselves by inequalities of thickness in the rolled sheet metal. These sheets, besides, ought, in order not to be cooled too quickly and to avoid too great dimensions, to be rolled under several thicknesses after having been bent repeatedly, and this causes risks of adhesion.

In modern sheet rolling mills, the tendency is more and more to substitute for the old rollers automatic trains, which, without the intervention of a workman, roll, bend, re-heat, and cut the sheets. In these rollers, the risk of inequalities of thickness in the sheets and adhesion to each other is avoided by heating the interior of the cylinders, so as to reduce the differences of temperature caused by contact with the sheets, which are allowed to cool slowly.

INDUSTRIAL NOTABILITIES--No. 21

W. D. BEATH was born on a farm, was a farmer at fifty, and still farms. Incidentally, he makes cranes and runways at Toronto. Once upon a time he was wheeling manure in his barn at Oshawa. The floor was uneven, and so much manure fell over the side with the shaking of the wheelbarrow, it made W. D. sit down and think. He noticed that the ceiling had a more even surface than the floor. If only he could wheel manure on the ceiling! Then, visions of a runway with switches entered his brain. He committed his thoughts to paper, and unlike most inventors, he took his drawings to a machine shop, where he got his litter carriers put together on a contract basis. The machine shop was run by the Oshawa Wire Co., since dead. W. D. Beath survived, and his visions too.

One morning the Oshawa farmer awakened to find his device patented in Canada and the United States. History records instances of two men making a discovery simultaneously. Remember Dr. Cook. It was strange, however, that the inventor of the same litter carrier lived in Oshawa. Thus history itself, whether the discovery be at the North Pole or at Oshawa. But watch this undaunted farmer. He set to work to make something even better than his first, and he succeeded. To-day, his first creation is off the market, having been surpassed by its own creator.

Having produced something marketable, W. D. Beath leased his patent rights to The Metal Shingle & Siding Co. of Preston, Ont., for two years, and sent his son to learn the business.

WILLIAM DICK BEATH.

During this time the idea was developed and applied to work in foundries, machine shops and factories. Five years ago, father and son rented a small shop on Teraulay Street, Toronto, where they built their cranes and runways for three years, later erecting their present plant on Cooper Avenue. Now they employ about forty hands, and have a most up-to-date structural shop.

Beath Senior was born an inventor. As a farmer, everything that would go by power he stuck wheels on it. In those days, the farmers of Ontario did not have the labor-saving devices that are the feature of the West to-day. As a result, the Beath farm was a model one for miles around. He still runs a well-equipped 100-acre farm in the same neighborhood, and still has visions. In his younger days he was a specialist in plowing, and took seven first prizes in succession at provincial and township fairs.

He is fond of curling, but his hobby is his new work. You will find him on the plant among his mechanics, as black as the blackest of them. He is nearly sixty now, and has one son, L. B. Beath, who looks after the office end of the business.

So W. D. Beath, president of W. D. Beath and Son, makers of cranes, trolleys, etc., was a farmer until he was fifty, and in nine years has built up a big engineering business, after seeing visions on his farm.

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Vol. XI. FEBRUARY 12, 1914 No. 7

PRINCIPAL CONTENTS.

WORKSHOP ARITHMETIC.

BEGINNING with the February 19 issue of Canadian Machinery and alternating each week with the "Questions and Answers for Mechanics" Section, a course of lessons in "Workshop Arithmetic" will be given, and in order that it may have the fullest scope, the subject matter will be treated right from the foundation upwards.

Arithmetic in the workshop and factory is to-day perhaps a more necessary requirement than at any previous period of industrial history and enterprise, and conducing as it does to the cultivation of a sharp and clear intellect, in addition to facilitating and systematically contributing to high degree quantity and quality production, as well as to the advancement of the individual, there is no reason why beneficial results should not follow the study of each lesson, even by those who have got beyond what will be the necessarily introductory part.

WORKMEN'S COMPENSATION IN ONTARIO.

THAT the Workmen's Compensation Bill as drafted by Sir William Meredith has a slim chance in its present form of becoming law in the Province of Ontario, no one at all familiar with its contents for a moment doubts. It would seem also, that the longer action is delayed in its consideration by the Legislature, the more divergent will become the views of the two interests directly concerned, and the more difficult the task of reconciling these.

The Bill is to our mind its own condemnation, if for no other reasons than those of its over-enthusiastic reception by the operatives and its wholesale condemnation by employers. No amount of publicity praising of the Bill on the one hand and decrying it on the other will frighten either side into submission, and the sooner both sides realize that a Workmen's Compensation Bill worthy of the name, and to be effective, will have to embody the views and opinions of the opposing parties worked down to a mutually acceptable basis. Only by employer and employee getting together and not by bull-dozer legislation, will a sane and lasting arrangement be reached.

CARING FOR HIGH-GRADE HELP.

IN another section of the present issue of Canadian Machinery, a brief outline sketch is given of what has been done by the Windsor Machine Co., Windsor, Vt., towards the conservation of that operative help on which it, in common with most manufacturing concerns depend for commercial success. Although our title indicates in a specific manner the particular type of help, yet it must be admitted that care for all classes and grades of operators should be part of the concern of every business enterprise.

In large manufacturing and industrial centres, the problem of securing and holding the necessary help is not usually hard to solve, for rightly or wrongly men and women gravitate there, and in even the most prosperous times, no difficulty is experienced in engaging such additional employees as may be found expedient. There is more "life" about our big cities, more to do in our leisure hours, more in the way of social intercourse and entertainment, and small wonder is it then that help of every kind and type prefers such employment as ensures these adjuncts.

The trend of factory location has, however, been towards the country; if not in a wholly literal sense, at least so far as convenience to the social life of our cities is concerned. It is not necessary for us to dwell on the reasons leading up to this movement; high taxation being responsible for the migration of already established concerns, and high cost of suitable sites, together with high taxation making new propositions hold aloof.

The establishment of a manufacturing plant some miles beyond the confines of a large city means the procuring of and providing for the creature comforts of the various individual units of the help necessary, and while in the initial stages some difficulty is usually experienced, it will be found that, if the management plan for the leisure hour welfare as they do for the work hour output of their employees there will be no difficulty in both securing and retaining both skilled and unskilled help, even although the village lacks a lot of the tinsel of the city.

Many Canadian manufacturers who have "moved out," like the Windsor Machine Co., have found that profit has come through caring for their help, in addition to that arising from cheaper sites and lower taxation, and it is our belief that if more opportunity were afforded men and women to get "far from the madding crowd's ignoble strife," a higher degree of citizenship would result.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3....	19 50	20 00
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3.......	19 50	20 00
Clarence, No. 3........	19 50	20 00
Jarrow	.....	23 50
Glengarnock	......	26 00
Summerlee, No. 3......	22 00	.....
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1........	19 40	18 35
Victoria, No. 2X	19 15	18 10
Victoria No. 2 Plain ..	18 90	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh.........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal......	2.10
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh.....	1.20
Steel hoops, Pittsburgh..........	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; beaders, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base..	$2 15
Cut nails	$2 60 2 65
Miscellaneous wire nails...	75 per cent.
Pressed spikes, 5/8 diam., 100 lbs.	2 85

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ in., 100 lbs...	$2 30	$2 20
Heads, per 100 lbs.......	2 55	2 55
Tank plates, 3-16 in......	2 60	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	9 00	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate Washers	45
Machine bolts, 3/8 and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb off
Nuts, Hexagon, all sizes..	4½ per lb off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, bronze	70, 10, 7½, 10 p.c. off

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in...	75%
Finished Nuts over 1 in....	72%
Semi-Fin. Nuts up to 1 in..	72%
Semi-Fin. Nuts over 1 in...	72%
Studs....................	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 00	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings..	9 00	9 00
No. 1 wrought iron.....	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	13 00	12 00
New brass clippings....	8 50	8 75
No. 1 brass turnings....	7 25	7 50
Heavy lead	3 75	4 00
Tea lead	3 00	3 00
Scrap zinc	3 00	3 50

LIST PRICES OF W. I. PIPE.

Standard.		Extra Strong,		D. Ex. Strong,	
Nom. Diam.	Price. per ft.	Sizes Ins.	Price per ft.	Size Ins.	Price per ft.
1/8in	$ .05½	1/8in	$ .12	½	$. 32
¼in	.06	¼in	.07½	¾	.35
3/8in	.06	3/8in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	.....	.....	.....
10 in	3.50	....	.....	.....	.....
10 in	4.12	....	.....	.....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, 3/8 in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in. ..	....	....	67½	56½
X Strong P. E.				
¼, 3/8 in	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$16 00	$16 25
Electrolytic copper	15 75	15 75
Casting copper	15 50	15 50
Spelter	5 25	5 25
Tin	42 25	43 00
Lead	5 25	5 40
Antimony	8 50	8 50
Aluminum	21 00	19 00

SHEETS.

	Montreal.	Toronto.
Sheets, black, No. 28	$2.75	$2.90
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	4.00	4.15
Apollo brand, 10¾ oz. (American)	4.30	4.10
Queen's Head, 28 B.W.G.	4.40	4.20
Fleur-de-Lis, B.W.G.	4.20	4.20
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.40	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal.	0.23
Pure turpentine	0.66
Linseed oil, raw	0.62
Linseed oil, boiled	0.65
Plaster of Paris, per bbl	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Feb. 9, 1914.—While no marked improvement is noticeable in general trade conditions over those of last week, they are certainly no worse. An optimistic spirit is still very much in evidence and collections are improving surely, if slowly.

In machinery circles, things are still quiet. A few small orders were closed last week, but there will probably be little improvement in the trade in heavy machine tools for some time to come. In the smaller lines, enquiries are fairly plentiful, however, and a few pick-up orders help to keep up the feeling of confidence in the future. The Foss & Hill Machinery Co. report having sold a 3-ft. 6-in. radial drill to Warden King, Ltd., and an 18-in. lathe to the Dominion Glass Company.

The outlook in the steel trade is more encouraging of late, and it is doubtful if present low prices can persist much longer. In fact in the United States prices are already being gradually advanced and a corresponding movement in Canada may be looked for shortly. Good orders are now being placed for sheets by manufacturers of roofing materials, the orders being based for the most part on a year's requirements.

No official announcement has yet been made as to the future plans of the Canada Iron Corporation, the English bondholders apparently not yet having decided upon the best course to pursue. In the meantime, the various iron foundries of the Corporation are being operated, very profitably it is said. It is quite probable that an effort will be made to sell or lease,—the latter for choice,—the blast furnaces and mines.

The metal market continues quiet, though the demand for pig iron is fair. Purchasers, however, are merely buying for immediate requirements.

Toronto, Ont., Feb. 10, 1914.—What was said last week about the steel market would almost bear repeating this week, and still be true of conditions here. Apparently the market recovery is going to be very gradual, and dependent industries, like that of machine tools, will have some time to wait ere the awakening reaches them.

The chief topic among everybody connected with the steel industry is the statement of E. L. Cousins, chief engineer of the Harbor Commission, to the effect that a large American steel concern was negotiating for a ninety-acre site in the new area being opened for industrial purposes at Ashbridge's Bay. Mr. Cousins stated that he was unable at present to give the name of the steel company.

Several prominent steel men in the city claim to know the name of the firm, but are saying nothing. Others have heard nothing and are anxious to secure some information, thinking that this might be a serious competitor about to enter the Canadian field. There are some who think that too much importance is being attached to the statement; that this big steel company will probably turn out to be nothing but a drop forging plant say, or a larger-than-the-ordinary foundry, which the newspapers usually group under the one heading of "steel plant."

Steel Prices.

Prices of steel bars and shapes have not changed during the week, and the tendency is still upward. There has been no cutting in prices to speak of, and both American and Canadian steel companies have been doing a fair business. While manufacturers are not placing orders very freely, most of them are covering themselves in view of the warning given by steel makers that prices will go up this year.

The nut and bolt plant of the Steel Company of Canada, at Swansea, is being kept fairly busy with orders. Things are rather quiet, though, at this firm's rolling mills, at Belleville. The bulk of the trade is being done in finished goods, the demand for raw material not being so marked. In the city, there has been a good demand for reinforcing bars, indicating that building will most likely be good this year. There is a likelihood that Canadian makers of pig iron will raise their prices before long. The demand for screws, nails and wire is good, though it might be much better.

Machine Tools.

It is frankly admitted by leading brokers that the machine tool market has not yet shown any marked signs of recuperation. This market depends proportionately on other lines, and any dullness elsewhere is reflected in the sale of tools. The sales manager of one of the largest Canadian machine tool manufacturers, who was in Toronto this week, stated that while they have succeeded in landing some very good business during the first few weeks of the year, he did not expect a complete resumption of business in this line until the summer. On the other hand, there is a fairly brisk demand for specialties and engineering supplies, including transmission equipment, etc.

Business continues quiet in the metal market, the only feature being a jump of a cent a pound in the price of tin.

The Lumen Bearing Co., West Toronto and Buffalo, N.Y., announce that they are indefinitely retiring from the Canadian field. Their American business has developed so rapidly, and is now so large, that they deem it advisable to concentrate all their energy and attention to that end. The Canada Metal Co., Toronto, have purchased the die casting business of the Lumen Bearing Co., including die casting equipment and goodwill, as well as considerable general foundry equipment. They have also taken over the manganese bronze business of the retiring firm. Mr. Kester Barr, the Canadian manager, will remain in Toronto for a few weeks looking after the disposal of machinery, etc. The foundry will be leased. The quality of The Lumen Bearing Co. product has always been of highest quality, and it is with regret that we announce their withdrawal from Canada.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Berlin, Ont.—It is announced that the Rutenber Company, manufacturers of automobile engines, will erect a factory here in the near future.

Brantford, Ont. The Board of Works will recommend to the council that a civic blacksmithing outfit be installed at the West Brantford quarters immediately.

Hamilton, Ont.—The Chadwick Brass Co. are negotiating for a site on or near Sherman avenue, on which they will erect a three-storey plant, with machine shop, plating rooms, etc.

Bedford, Que.—The Excelsior Needle Co., Torrington, Conn., who recently purchased the business and plant of The Carey Needle Co., here, will erect an addition to the present building.

Toronto, Ont.—The Canadian Seamless Wire Co., 88 Teraulay St., have awarded the contract for the erection of a plant on Clinton St. to J. B. Baker, Toronto.

Vancouver, B.C.—J. G. Hackel, managing director of Commercial Cars, Ltd., Luton, England, was here last week, looking for site on which to build a Canadian plant.

Peterborough, Ont. — The Canadian General Electric Co., Peterborough, Ont., is reported to be contemplating the building of electric locomotives, and will expend $150,000 for that purpose.

Port Mann, B.C.—The roundhouse being built by the C.N.R. is almost completed. The foundation of the car repair building is being laid, and its erection will be commenced in a few days.

Sault Ste. Marie, Ont.—The Algoma Steel Corporation's merchant mill commenced operations last week with a full day working force. Contracts on hand will keep them going four or five months.

Edmonton, Alta.—The Presto Heater Company of Alberta, 224 Jasper East, are making arrangements in Chicago to start operation of a plant here, for the manufacture of furnaces. J. E. Bertrand, secretary-treasurer.

Winnipeg, Man.—The plans for the new Engineering building for the University of Manitoba are in the hands of the architect. They do not include at present either a foundry, forge, or pattern-making shop.

Edmonton, Alta.—N. L. MacDonald, of the Dickson Steel & Bridge Co. has applied to the city for water. He wants to erect his buildings as soon as the city promises definitely to provide the water, and if possible the power.

Bridgeburg, Ont. — Frank Sweet, a Buffalo ironwork manufacturer, who has secured large contracts in Welland and other Canadian cities, is looking for a site for a plant in which to assemble all iron he contemplates using to fulfil his contracts.

Coquitlam, B.C.—A recent issue of the British Columbia Official Gazette announced the incorporation of the Coquitlam Brass Works. This is the company organized by a Mr. Bond, of Vancouver, who announced his intentions some time ago of erecting a large plant here.

Toronto, Ont.—Work is being rushed on the new brick and steel plant of Foundry Specialties Co., on Cherry St. A 21-year lease has been secured on the present site. A contract for a crane has been let to John T. Hepburn, Toronto. Grey iron castings will be made.

Toronto, Ont.—A plant will be built by The Clauss Shear Co., Ltd., for the manufacture of shears, scissors, razors, manicure articles, etc. Among the chief shareholders are John H. Clauss, Toledo, O., and John and Henry Becker, Cleveland. A charter has been secured for Ontario.

Waterloo, Ont.—The Beam Bros. Manufacturing Co., Ltd., will erect a plant here to make threshing machines, engines, boilers and other farm implements. The firm is capitalized at $40,000. Nathaniel Beam, engineer, and Gideon Beam, Waterloo, Ont., are interested.

Oxford, N.S.—The Oxford Manufacturing Co. have added a number of new machines and new methods, thus improving the products. They find it impossible to keep pace with their orders. The Oxford Furniture Co. and Oxford Foundry & Machine Co. are both adding new machinery.

Vancouver, B.C.—J. S. McDonald, of Eau Claire, Wis., was here last wek making preparation to start an iron and steel foundry for the manufacture of gas engines and other machinery. Mr. McDonald states that raw material can be obtained here for the foundry, and the product manufactured as cheaply as in Ontario.

Toronto, Ont.—The Polson Iron Works are negotiating with the Harbor Commission for a 27-acre site on Ashbridge's Bay, on which the latter will locate their shipbuilding yards.

Toronto, Ont.—E. L. Cousins, chief engineer of the Harbor Commission, stated this week that an American steel company was negotiating for a 90-acre site on Ashbridge's Bay.

London, Ont.—Two Detroit men were in London last week conferring with P. J. Edmunds, patent attorney, concerning the establishment here of a foundry to produce a new type of grate bar. The Canada Grate and Supply Co. is the name under which the new concern will operate.

Montreal, Que.—The St. Lawrence Welding Co., Ltd., Montreal, are opening a new branch at St. Catharines, Ont., to handle shop and portable work. Their present Montreal quarters have proved too small for their rapidly-growing business, and on May 1 next they will move into more spacious premises at 138-140 Inspector Street, Montreal.

Saskatoon, Sask.—A large Scotch firm engaged in the structural iron and steel business, has written, asking if a site of from 12 to 15 acres could be obtained as a bonus, on which to build a plant, which would be the headquarters for Western Canada. The head of the firm will be in the West this spring to look into the question.

Galt, Ont. — The plant of Shurly, Dietrich, Ltd., makers of saws and iron beds, was destroyed by fire, Feb. 6. The loss is estimated at $200,000, on which there is less than $100,000 insurance. Business had begun to pick up with this company, and a large number of orders were in. These will be filled at the St. Catharines plant.

Goderich, Ont.—The American Road Machine Company, of Canada, Ltd., have prepared plans for their new plant, which they will erect at an estimated cost of $90,000. The new plant will be of concrete and steel, 400 x 70 x 30 ft., the machinery to cost $30,000. Much of the machinery in the old plant will be used. A galvanized iron goods plant will also be built later.

Development, Application and Testing of Pneumatic Tools-I*

By H. I. Brackenbury

Pneumatic appliances and apparatus adapted to one or more stages in the manufacture of mechanical and general industrial products determine by their installation in a plant, just to what extent the management of the latter are keeping pace with the progress and development being made in this particular sphere. Applied compressed air claims equal classification with electricity in the revolutionizing of manufacturing methods.

THE pneumatic hammer, reduced to its lowest terms is a combination of a cylinder, reciprocating piston, a valve controlling the flow of motive fluid to and from the cylinder, and a throttle-valve in the supply-pipe. Considered in this light, credit must be given to James Watt, Savery and others as the original inventors. All the earlier engines were designed to produce rotary motion or to work pumps with or without crank and flywheel, but the idea of using a free piston was first suggested as a good means of rock-drilling.

The Low Invention.

Amongst the earliest inventors in this field was George Low, an Englishman, who in 1865 patented a rock-drill having a hammering piston. He states in the specification that his device can be used for riveting, etc., but it was in no sense of the word a hand tool. Low is perhaps chiefly interesting as being the first to show a grasping-handle with manually-operated throttle-valve within the control of the operator's fingers.

*From a paper read recently before the Coventry Engineering Society.

The Doering Invention.

Low was followed two years later by Doering, another Englishman, with a rock-drill which shows originality of design (see Fig. 1). He was the first to patent a pressure-operated valve for this class of machine, in which the piston and valve are mutually interdependent for their respective motions; that is, the valve controls the motion of the piston, and the piston performs the double function of striking the blow and acting as a valve to control the motion of the valve itself, a principle which, in many forms and modifications, is used in all modern pneumatic hammers. A working model of Doering's machine has been made and used for demonstrating various points in patent litigation concerning pneumatic hammers.

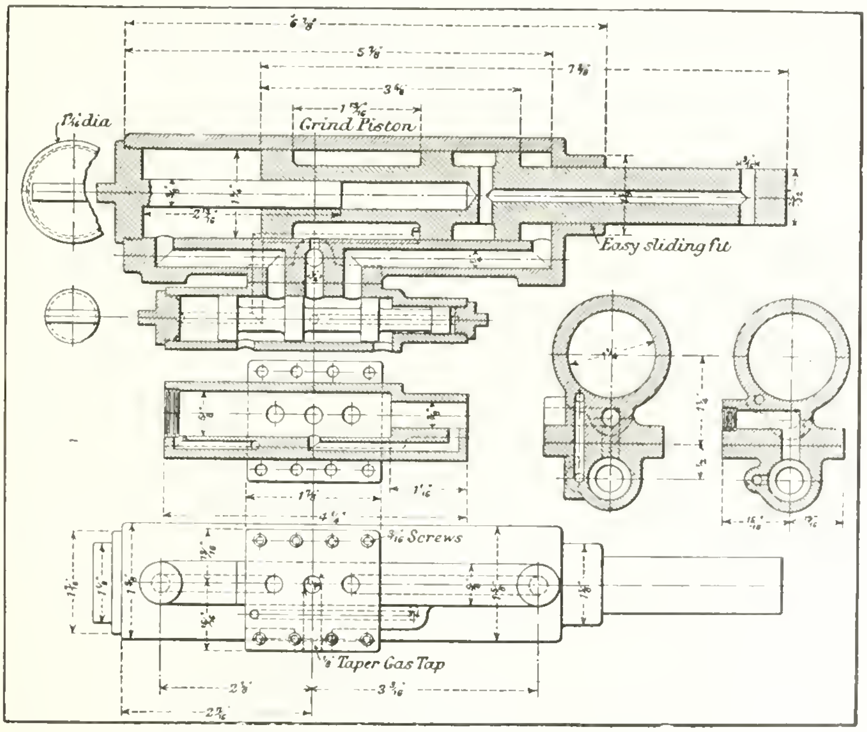


FIG. 1. DOERING'S ROCK DRILL, 1867.

Dennis Hand Pneumatic Hammer.

The first to patent a hand pneumatic hammer, Fig. 2, was Dr. S. W. Dennis, a San Francisco dentist, who was granted a patent in 1877 for a pneumatic dental mallet—United States patent No. 195, 102. This tool had a valve which controlled the admission and exhaust of the compressed air to and from one end of the cylinder only. The piston in moving outward to strike its blow compressed a spring which, after exhaust took place, reset the piston for the next working stroke. The compressed air was supplied by a small foot-power compressor. This device did not come into general use. Dr. Dennis's patent seems to have been chiefly utilized for the purpose of proving that some of the claims of later inventors in this field were not nearly as original as they tried to make out.

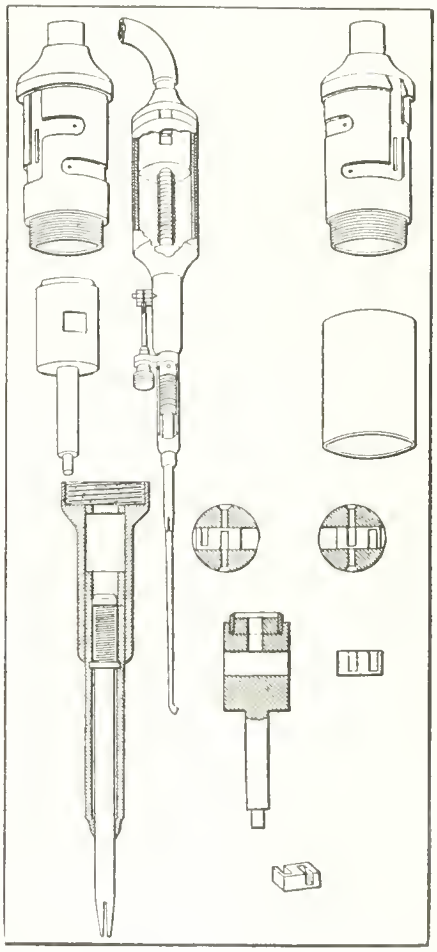


FIG. 2. DENNIS DENTAL MALLET, 1877.

Boyer Pneumatic Hammer.

The first serious attempt to produce a practical metal-working pneumatic hammer seems to have been made by Boyer, of St. Louis, who, in 1883, patented a "chipping-machine" provided with a grasping-handle and a throttle-valve controlled by hand, Fig. 3. In principle, Boyer appears to have followed somewhat the lines of Dr. Dennis.

Instead of using a spring for resetting the piston, Boyer used a piston of two diameters, and, under the shoulder so provided, used constant air pressure on a small area for this purpose. The piston, in its working stroke, therefore, operated against this constant pressure, tending to hold it in its rearward position. The valve in Boyer's first device was thrown backward and forward by means of a stud projecting laterally from the piston engaging a slotted extension of the valve-stem. The valve was placed in a chamber close alongside the cylinder and parallel to it. Nothing came of this device, and Boyer seems to have done nothing further in this field for about twelve years or more.

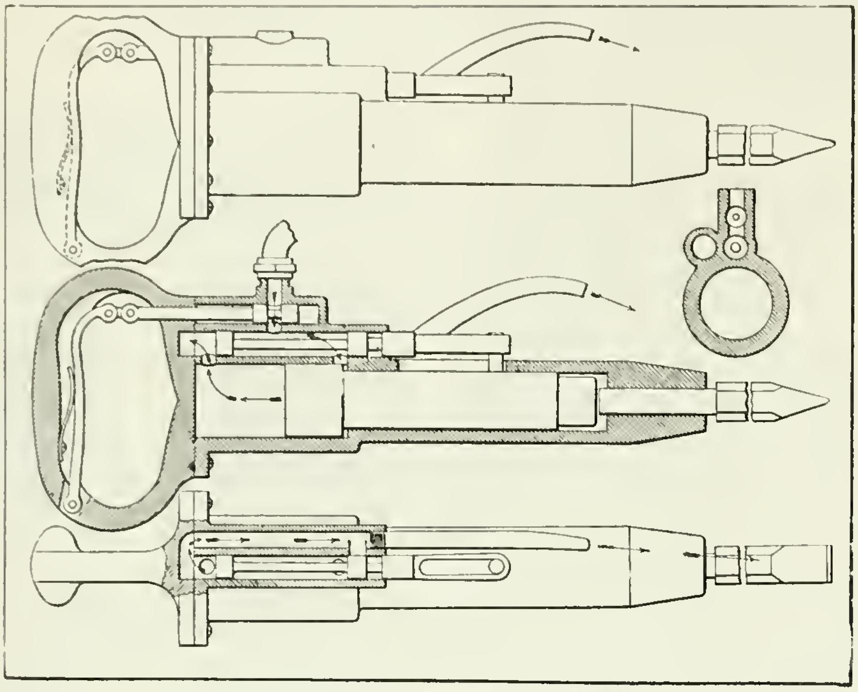


FIG. 3. BOYER'S CHIPPING MACHINE, 1883.

Brazelle Invention.

We now come to the invention of Benjamin Brazelle, also of St. Louis, who in the early eighties obtained a patent in the United States for a steam-pump, Fig. 4, disclosing a differential-area piston attached to a pump-plunger, together with a differential-area valve, each of which served to control the operation of the other. Brazelle's device is not very different from Doering's, but by using a differential-area piston in connection with a differential-area valve the construction is in consequence simpler than that of Doering. Brazelle states in his specification that his machine may be used not only for pumping, but for "working hammers or stamps, rock-drilling, and the like." This invention has also been successfully used in the patent courts, as an anticipation of the claims of Boyer and others in later types of pneumatic hammers.

Miscellaneous Inventions.

Boyer seems to have drawn inspiration from Brazelle's invention, for in 1896 he brought out a metal-working pneumatic hammer involving Brazelle's design, but modified to suit the conditions of chipping, caulking and riveting, Fig. 4a.

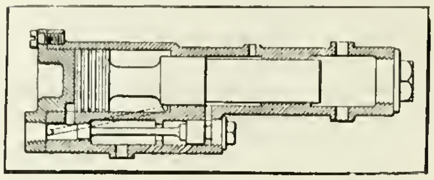


FIG. 4. BRAZELLE'S STEAM PUMP, 1883.

About this time other inventors had placed on the market pneumatic hammers of the valveless type which were used for stone-cutting, and in a small way for caulking ship and tank-plates. These hammers were necessarily of very short stroke, and depended for their effect upon extremely rapid blows, some of them making from 3,000 to 5,000 strokes a minute. A number of the earliest ones were used in Cramp's shipyard in 1894. They were not sold, but leased by the makers at one dollar per day.

These tools were not provided with handles, and were not only cumbersome, but the vibration was so bad that the workmen objected to using them. Hammers of this type, of small size, are still used largely for stone-carving, being considered best for the purpose, not only in principle, but on account of low cost. Boyer was followed by Keller, Fig. 4b, Kimman, Richards, Meissner, and other American inventors, and the pneumatic-hammer industry quickly became an important one throughout the world. It was soon found that there was a large field for pneumatic hammers for closing rivets, and that the Boyer and other types of hammer, based more or less on the principle of Doering and Brazelle, and which involved the use of a piston greater in length than the length of its stroke, could not be made sufficiently

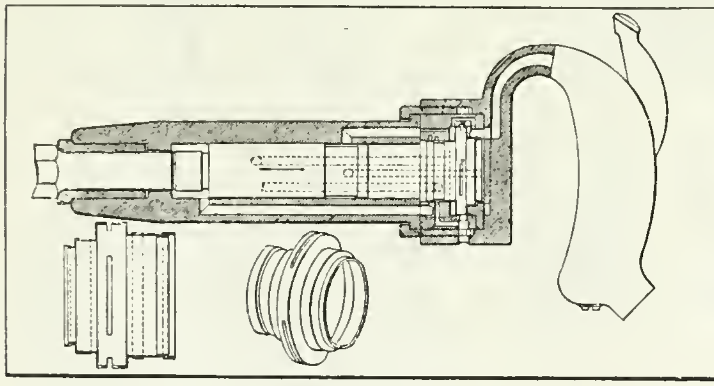


FIG. 4A BOYER PNEUMATIC HAMMER, 1896.

Cuts, Courtesy of "Engineering."

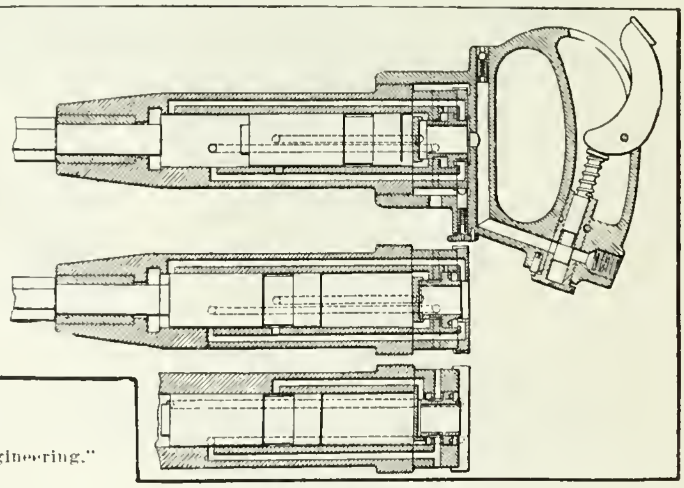


FIG. 4B. KELLER PNEUMATIC HAMMER, 1899.

powerful to do heavy riveting without making them of such dimensions that they would be too heavy to be used by one man.

The demand for pneumatic riveters led to the invention of the "long-stroke" hammer—i.e., one in which a comparatively short piston was made to travel a distance much in excess of its own length. This was the first instance in the pneumatic-hammer art which called for original invention. Previously nearly all the so-called inventions had been largely adaptations of inventions in other fields to this particular purpose.

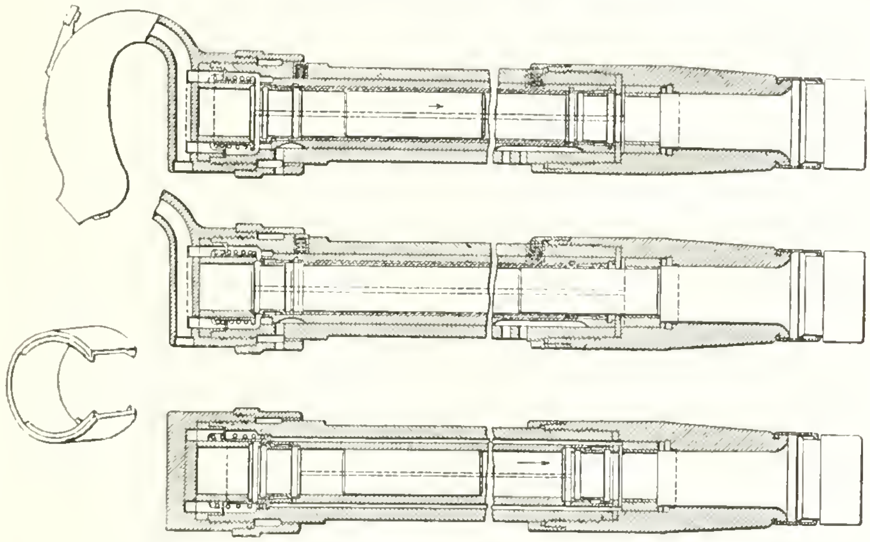


FIG. 5. BOYER LONG STROKE PNEUMATIC HAMMER, 1899.

Boyer Long-Stroke Hammer.

Boyer was probably the first to make a long-stroke hammer, and he accomplished it about 1899, by employing a valve at each end of the cylinder, connected together by two rods of small diameter placed in longitudinal passages drilled in the walls of the cylinder, Fig. 5.

The valves worked simultaneously by means of air pressure created through "cushioning" of the piston as it neared the end of its stroke. The whole was much too intricate and delicate to stand hard service, however, and was soon abandoned.

Meissner Long-Stroke Hammer.

Meissner, of St. Louis, at about the same time brought out a long-stroke hammer, with one valve only. This valve was so arranged as to be moved in one direction by live air pressure admitted to the smaller of its two differential areas, and in the other direction by pressure created by the "cushioning" of the piston on its return stroke. The design involved "throwing" the piston rearward by air pressure exerted on it through about a third of its stroke, the balance of the stroke being accomplished by its own momentum. A full stroke was assured, however, because the valve, being moved rearwardly by compression of air caused by the piston, would not shift until the full rearward stroke of the latter was accomplished.

The Meissner invention assured the success of the "long-stroke" hammer, and the main principle of his invention, which he seems to have failed to protect as broadly as he might have done, has been adopted with modifications by all the makers of pneumatic tools throughout the world.

"SAFETY FIRST."

A stationery form in use at the Sydney Mines Collieries of the Nova Scotia Steel & Coal Co. has for its heading the words "Safety First." What do the words imply? Austin King, chief inspector of mines for the H. C. Frick Co. makes answer in the Uniontown "Standard" as follows:—

"What is the meaning of "Safety First?" "Safety First," though having a sort of general or common significance to all, has for each class of officials and workmen, a special meaning which varies according to the nature of and conditions surrounding the work to be done.

To the president, it means that, as far as he is able, every provision shall be made to insure the safety of the workmen, no matter what the cost. To the general superintendent, it means anxious inquiry from superintendents and other officials—the scanning of reports daily regarding it, and the giving of many orders regarding its strict observance notwithstanding the large increase it often makes in the cost.

To the engineer it means well-considered lay-out for mines with respect to ventilation, drainage, haulage, width of barrier pillars, and the design and installation of suitable machinery and safety appliances. To the mine inspector, as its special guardian, it means much care and watchfulness, and ofttimes the performance of disagreeable duties.

To the superintendent it means that he must provide supplies to insure safety in all departments and make himself as familiar as practicable with the conditions that make for safety, so as to be able, if called upon by his subordinates, to advise how best to avoid accidents.

To the mine foreman it means competent and reliable subordinates, the giving of clear-cut and unmistakable orders and directions where safety is concerned —no straddling of the question can be permitted.

The fire-boss, rib-boss and shot-firer will be made to feel that, while the faithful performance of their duty is appreciated, the higher duty of conserving life and limb is still more appreciated by their superiors.

To the miner it means that he will set that post or cross-bar, as may be required before loading the car, though it may not be ready for the driver when he calls for it. The driver will show that he understands its true meaning by not taking any forbidden risk in doing his work.

To the chief mechanic and electrician it means that they will keep the machinery, apparatus, and wiring in their charge in safe working condition: they will be sure that those they have placed in charge are sober and reliable, and they will encourage them to report promptly anything that they may notice that would lead to danger.

It means that when a fatal or serious accident happens it should be thoroughly investigated, so that the cause, if possible, may be known! and such regulations or devices, or both, as are best calculated to prevent a recurrence should be promptly made or supplied and obedience to or use of them enforced as far as possible.

Having briefly dwelt on a few of the important phases of the meaning of "Safety First," may we not ask: What would be the result if each one did his best to carry out its requirements? There can be but one answer—a very large reduction in number of fatal and serious injuries."

Largest Pelton Wheel in Switzerland.— The hydraulic plant situated on the Lontsch River in Switzerland is now using what is claimed to be the largest Pelton wheel in Europe, the wheel being of 15,000 horse-power capacity. In the same station there are already six Pelton wheels of 6,500 horse-power, so that the addition of this latest wheel brings the output of the Lontsch plant up to 54,000 horse-power, and makes it one of the largest plants in Switzerland.

Development of Chain Gearing for Power Transmission--II*

By H. T. H[illegible]age

Chain gearing as a possible solution of the problem of furnishing an improved means of transmitting power to machines in factories and workshops is dealt with in the accompanying article, while a resume is also given of the progress made in design, manufacture and application as exemplified in modern installations.

THE rocker joint type of bearing was patented by E. F. Morse, of Trumansburg, U.S.A., in 1893. In it the idea of a pin and a journal bearing has been departed from, a knife-edge rocking on a plane being substituted, the idea being probably that if there were no rubbing there would be no friction, and consequently no wear. The sectional pins are made from cold-drawn steel bars, and hardened. Whilst the underlying idea of eliminating friction, and consequently wear, is excellent, this type of bearing has not fully realized this feature in practice. It makes a very durable type of chain, and has given very good service indeed, especially under unfavorable conditions, such as hot and dusty atmospheres, and absence of lubrication.

Liner Type Joint.

The patent was granted to J. M. Dodge, of the United States, for this type of bearing in 1904. The bearing consists of a case-hardened steel pin turning between segmental bushes, each of which is fixed in one combination of the chain. As originally made, cold-drawn strip was used for the links. This design is still in use in the United States. Later the links were placed side by side in pairs, with a view to fixing the liner in the link, and ultimately much heavier plates were used for the same purpose with much success. At the same time the shape of the holing was improved by Hans Renold, Ltd., the total effect of these improvements being to give a much more flexible chain, a greater possibility of backward bend, and a more nearly perfect attainment of the desire to fix the bush or liner in the link. It is obvious that the underlying idea of the liner-bearing is to increase the bearing area and thus retard wear. The liners are made from strip steel and case-hardened, and the pins also are case-hardened.

Comments on Foregoing Designs.

It will be readily understood that nothing like finality has yet been reached in this important part of the design of silent chains, and that this implies no question or detraction as to the suitability of present designs. In point of fact, every one of the designs above-mentioned, properly carried out, is capable of giving, and has given, a satisfactory and durable chain. Nevertheless, since the extension of pitch is really the feature, as far as the chain is concerned, that sets a limit to its life, and sets a limit also to the application of chain gearing, as regards magnitude of power transmitted, ingenuity and skill in design successfully applied at this point is sure of a reward. Improvements in the design of bearings will not only increase the durability of drives of ordinary magnitudes, but, by rendering it possible to use smaller chains to transmit the same power, will reduce the cost of the transmission.

Circular Pin Type.

The important difference between the liner type and the other types, where the pitch and width of the chain is the same, is the difference in the amount of bearing area. The bearing area can be increased in two ways: by increasing the diameter of the pin, and by increasing that portion of its length that serves as a useful bearing. With the plain link and the multiple-block type it is possible to use a pin of larger diameter than can be used in either the bush or liner type.

The multiple-block construction then is a better one than the bush construction in so far as the same proportion of the length of the pin is available to resist wear, and a larger pin can be used. On the other hand, the bearing surface available in the bush and multiple-block designs is more effective than in the multiple-link type, because the bearing surfaces are individually larger.

Again, with the plain bush type of link it is possible to use glass-hard steel bushes, and consequently to obtain a greater degree of hardness; but as an offset to this it is not possible, as in the case of the multiple-block type, to make special provision for lubrication. With the liner type of construction the whole of the length of the pin is available for bearing, and more than off-sets the diminution of the area, due to the reduction of the pin diameter. There is one weakness in it, however, and it exists also in the rocker type. In chains of these two designs it is found by experience that the extension of pitch takes place as the result of wear, not only between the pin and its bearing, but also as the result of wear between the components of the bearing and the link. This points strongly to the desirability for one element of the bearing being an absolute fixture in one combination of the chain, and in the liner type this has been substantially achieved by the use of thick links and force fits.

The Rocker Type.

The desirability of using this principle for a bearing must appeal strongly to every engineer. In addition to the difficulty mentioned in discussing the liner type, there is another, and that is, the difficulty of preventing the rocker or knife-edge from sliding on its plane. This sliding is quite likely, in fact, is certain to take place when the chain is under tension as well as when it is not, and it can only be prevented by fixing the rocker and the pin, not only in their respective combinations, but also by fixing them, or at any rate by reducing the clearances to a minimum, in the alternate combinations, and as these clearances become increased by wear, the sliding again begins to occur.

The Future Outlook.

It seems probable that the type of bearing that will finally prevail will be the circular-pin type, because, as far as existing experience goes, it has certainly not given inferior results to the other, and it does seem to have greater possibilities as regards improvement. Improvements in this type will have for their object:—

The increasing of the areas available to resist wear.

Increasing the degree of hardness of wearing surfaces.

Improving the methods of lubrication.

A very important feature of all such improvements will necessarily be simplicity.

In connection with the first-named object it can be stated that it is mechanically possible to produce a chain that will permit the use of a larger diameter pin than can be used with the liner type, and will, at the same time, permit of as great a proportion of the length of that pin being available. It remains to overcome the manufacturing and commercial difficulties. Such a chain would also have the advantage that instead of a half of the tooth face of the chain bearing on each wheel tooth, practically the whole of it would come into play.

Tooth Form.

It is not necessary to say much more than has already been said on the subject of tooth form. The only portion of the

*From a paper read recently before the Manchester Association of Engineers.

tooth profile that is left to be fixed, when the link has been designed, is the top—i.e., the depth of tooth. The actual shape of the top of the tooth is, of course, of no consequence, but the depth is important, inasmuch as it directly affects the length of the life of the chain. This dimension will evidently be fixed at the same time as the link is designed, and will be made as great as possible, without spoiling the shape of the link.

Methods of Guiding.

There are three methods of keeping the chain on the wheels in general use:—

By flanging one of the wheels.

By a running flange in the chain, which runs in a groove on the centre of the wheel.

By running flanges on the outside edges of the chain, which overlap the edges of the wheel.

Perhaps the most generally satisfactory of these three methods, but certainly the most expensive, is the flanging of one of the wheels. Any end-play in the shafts, or defect in aligning the wheels properly, can be allowed for by making the wheel extra wide, and faults in alignment or parallelism do not lead to such rapid destruction of the chain as is usually the case with other methods of guiding. The centre guide-chain has a solid link inserted in every alternate pitch, and a groove is turned on the wheel, into which this link, or running flange as it may be called, will fit and run. This is a very cheap and satisfactory method of guiding, and is probably more generally used than any other. The objections to it are that it requires that the wheels should be carefully lined up, and the shafts made parallel, otherwise great stresses are brought to bear on the pins in the chain-bearing, and the chain is rapidly racked to pieces. A certain amount of error, of course, is of no consequence, because it is usual to allow from 0.03 in. to 0.08 in. clearance between the centre guide-plate and the groove, and, in addition to this, the chain has, after all, a certain amount of lateral flexibility. For these reasons excessive accuracy in lining up is unnecessary.

The third method of guiding, by outside flanges on the chain, has the advantage that it is cheaper than flanging the wheels, and eliminates also the expense of cutting the grooves in the wheel. There is a possibility, however, that faults in alignment may force the outside guide-plates off the pins and cause the chain to fall to pieces. This method of guiding has also the disadvantage attached to the centre guide—namely, that faults in alignment bring excessive stresses to bear on the pins and bearings, resulting in rapid wear.

Bush Roller Chain.

This type of chain was invented in the year 1880, by Mr. Hans Renold. It is so called because the bearing consists of a pin and bush knuckle-joint, with a roller running on the outside of the bush to relieve the friction between the chain and the wheel at entering and leaving. The pin is carried by one pair of side plates, and the bush by the adjacent pair, the roller running freely on the outside of the bush. The pin and bush are fixed in their respective side-plates, in order that the motion of bending will be taken up in the bearing proper, which is prepared for it.

In gearing with the chain-wheel, the teeth of the wheel pass between the side-plates of the chain and engage with the rollers. There is probably no doubt about it that, in a new chain at any rate, the action of the roller is not so much in relieving friction between the chain and wheel-teeth as in absorbing impact. It will be convenient to defer the consideration of how far this type of chain complies with the general specification until the design of the chain and wheel-tooth form have been discussed.

Roller Chain and Wheel Design.

The gearing element in this type of chain is the roller, and the link form, therefore, offers no problem to the designer, other than those connected with strength, weight, and possibly appearance. The stud must be of such diameter and length that it will give sufficient bearing area to transmit the power or pull required, efficiently. The outside diameter of the bush will, of course, have its own effect on the shape of the link head into which it is fixed. A certain amount of impact is transmitted to the bush by the roller, but the bush in its turn is well supported by the stud, so that bushes very rarely suffer on this account. The amount of bearing area between the roller and the bush is naturally not nearly so important, although necessarily rather greater than between the bush and the stud. The diameter of the roller affects the size of the teeth. An excessively large roller would give an impossibly small tooth. On the other hand, the internal diameter of the roller is fixed by the diameter of the stud, and tthe roller must be stout enough in thickness to resist the impact.

The bush roller-chain was originally designed for the transmission on a bicycle, and later it came into use for the rear-drive on a motor-car. As a general rule each builder of motor-cars fixed the dimensions of his own chain, and the result is that roller-chains stand very badly in need of standardization on rational lines. It has been tacitly decided by each manufacturer of roller-chains to make each of the various sizes selected at different times by different makers of motor cars, but it would require considerable stretch of the imagination to show that this series of chains can be considered in any sense a reasonable expression of the principles above enunciated.

Tooth Form.

The exact form of the wheel teeth has been the subject of careful study and experiment. The requirements are substantially the same as for silent chain-gearing—namely, that impact at entry shall be a minimum, that movement of the chain after entry, with regard to the teeth, shall also be a minimum, and that small increases in pitch of the chain, due to wear, shall not affect the fulfilment of these conditions. A good many different tooth forms have been in use with different makers at different times, but the gap that seems most nearly to fill the above requirements consists of:—

A root-circle equal to the roller diameter, or a few thousandths larger.

Two straight lines at 60 deg. to one another, forming tangents of that circle.

An arc of a circle, or circles, joining on to these tangents and forming the top of the tooth, determining its height.

The manner in which the various parts of this form fill the requirements is as follows:—

When the chain is new and of correct pitch, the roller falls into the root-circle, and the impact is taken by a considerable portion of the circumference of the roller, also by a considerable area of the wheel. If the chain is worn somewhat, the incoming roller comes into contact with the tooth-surface at an acute angle; in other words, the incoming roller strikes it a glancing blow in the tooth of the wheel, with the result that injury to the roller or to the wheel is minimized and noise reduced.

In the action of the worn chain on the wheel, one of the rollers beds down into the root of the gap, and the others take up positions on the straight flank, which depend on the amount of extension of pitch and their distance from the roller that is bedded down. The position of the bedded-down roller depends on the relation between the tension on the slack side of the chain and the tension on the driving side, and there is consequently a certain amount of movement between the roller and the wheel teeth whilst in engagement. It is evident, however, that the bedded-down roller is at the point of least pressure between chain and wheel, and consequently this motion does not induce much friction or cause much wear. Evidently the same kind of thing occurs with the silent chain; the unimportant character of the motion is shown by the fact that very little, if any, tooth face-wear occurs in normally designed silent chain-drives. The curves which form the upper portion of the teeth are so designed that on entering and leaving, the roller does not touch them at all, but comes right in, and is lifted right out of its final position, without rolling or sliding.

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

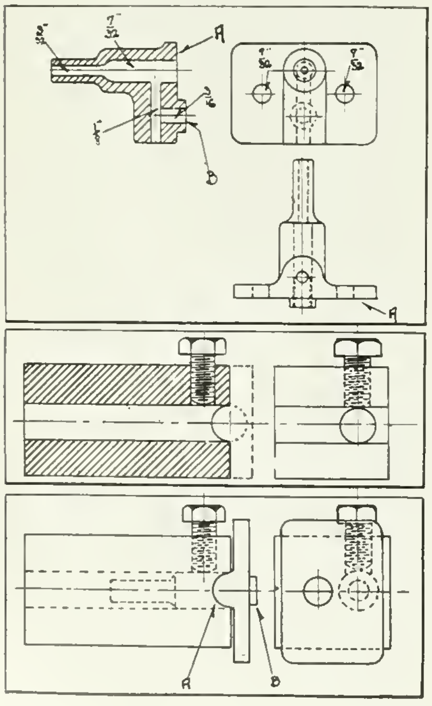
MACHINING AN OIL-FUEL INJECTOR NOZZLE.

By G. Black.

ONE of the products of the shop with which the writer is connected is a line of oil engines operating on kerosene. These engines, which are rated at 5 h.p., are built at the rate of one hundred per week. One of their component parts is the fuel injection nozzle shown in Fig. 1. These nozzles are of gunmetal and come through the shop in batches of one thousand at a time. In order to machine them economically and expeditiously the simple fixtures here shown were made.

The first operation is to face the casting at (A) and to turn the spigot (B), Fig. 1. For this operation the fixture shown in Fig. 2 was devised. It consists of a piece of wrought iron, 1⅜ inches square by 3 inches long. Two holes were drilled through it as shown, and the portion shown in dotted lines was cut off, leaving a half-round groove at the end. The hole for the 5-16-inch set-screw was then drilled and tapped.

The fixture is held in a 4-jawed chuck, and the work to be machined is inserted as shown in Fig. 3. The set screw is then tightened slightly, and the chuck jaws are adjusted until the spigot (B) runs true. After the jaws have been correctly adjusted for the first piece, they are not again interfered with, succeeding pieces being inserted and held by the set screw and driven by the half-round portion which fits into the groove, as seen at (A), Fig. 3.



FIGS. 1, 2, 3. MACHINING AN OIL FUEL

The first machining operation consists of a roughing cut to get under the sand

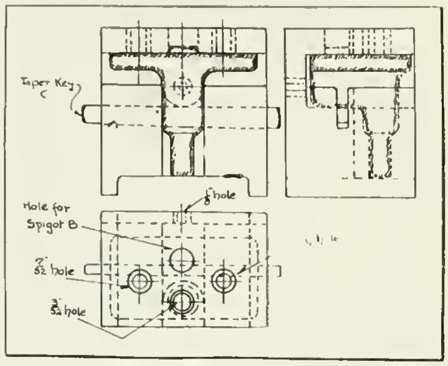


FIG. 4. MACHINING AN OIL FUEL INJECTOR NOZZLE.

skin. The turret tool holder is then re-set, and a forming tool, with an ⅛-inch step in it, turns the spigot to diameter and finish-turns the face (A) and spigot (B) to depth. The tail-stock of the lathe is furnished with a drill socket carrying a 3-16-inch drill. This next comes into play and drills a hole ½-inch deep, completing the first operation, the detail times for which are as follows:—

Chuck	.25
Rough turn	.30
Re-set tool and finishing turn	.45
Re-set tool, change speed and drill hole	.50
Check work with gauge and remove	.50
Total Minutes	2.00

The succeeding operation is that of drilling the remaining holes seen in Fig. 1, and for this the simple jig shown by Fig. 4 is used. The position of the nozzle in the jig is shown by the etched lines. It is secured in place by the taper key (C). The holes are all drilled on a Ward 4-spindle drill. The first spindle is fitted with a 7-32-inch drill, the second with a 3-32 inch drill, and the third with an ⅛-inch drill, while the fourth spindle is equipped with a geared head and friction drive for tapping. The whole drilling operation takes but 1½ minutes, the detail times being as follows:—

Place piece in jig	.30
Drill three 7-32-in. holes	.45
Re-set jig and drill one 3-32-in. hole	.25
Re-set jig and drill one ⅛-in hole	.25
Remove piece from jig	.25
Total minutes	1.50

This completes the machining of the nozzle, the total time being:—

Turning	2.0
Drilling	1.5
Total minutes	3.5

The limits of tolerance allowed on the piece were .002-inch.

COUNTING SPEEDS WITHOUT A SPEED INDICATOR.

By N. G. Near.

IT is not difficult to count shaft revotions up to speeds of 500 r.p.m., or slightly more without the use of a speed indicator. Count with your fingers, as follows:—

On nearly every rotating shaft or pulley there is some projection that you may allow to touch your finger or hand every time it makes a revolution. You can distinctly feel these "touches" and you can easily count them up to ten, mentally, because most of the numbers between one and ten have only one syllable—you can, therefore, count more quickly up to and including ten than you can beyond ten. Most of the numbers beyond ten are composed of more than one syllable, hence the mental formation is slower. As soon as you reach ten in your mental counting, make note of it with your little finger, then count ten again and make note of it with your second finger, next the middle finger, and so on. As soon as you have counted a hundred, i.e., as soon as you have used all the fingers of one hand twice, catch the time on the watch and speed is easily computed.

For example, I counted 100 revolutions by use of this method in 14 seconds. The speed then equals

$$\frac{60}{14} \times 100 = 428 \text{ r.p.m.}$$

AN ADDITION TO THE MULTIPLE.

D. O. Barrett.

A CERTAIN machine shop was equipped with an 8-spindle multiple drill press. The drill head was operated vertically by means of a screw instead of

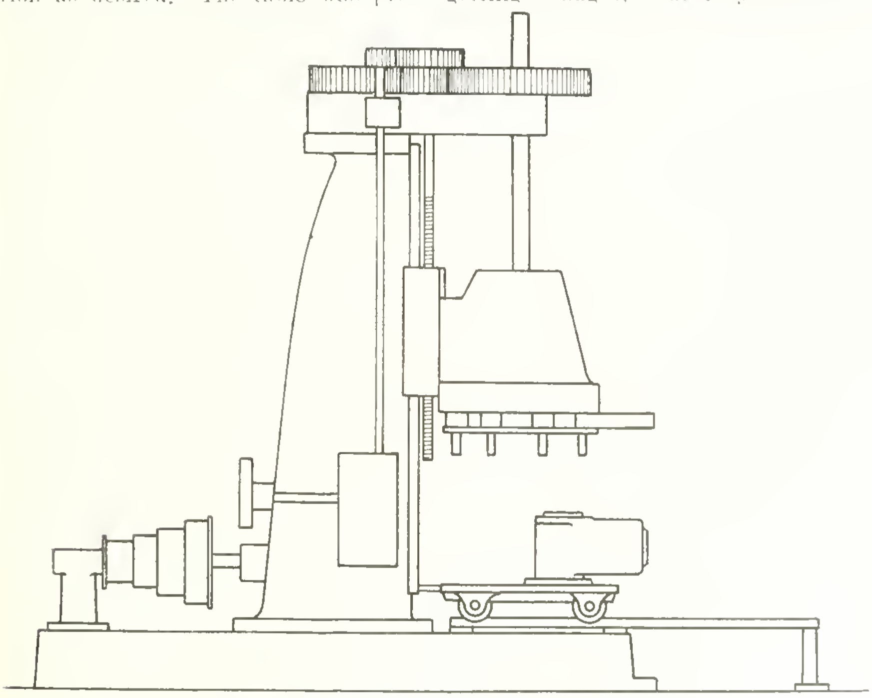
the usual rack and pinion. It was thus impossible to raise or lower it by hand. Some little time was therefore lost in throwing in the rapid traverse, and especially so if the head were raised far enough above the work to enable the operator to reach in to withdraw the work easily and without danger to himself. Orders had been issued to the operators to stop the press each time when putting in or removing work. The inertia of the heavy gears at the top, however, would keep the machine running a few moments after the belt was thrown off, and so it was most natural to leave the press running continuously. In reaching in to remove some work, one of the operators had the sleeve of his jacket caught by a drill, and before the press could be stopped was injured in such a manner as to subsequently lose the use of the hand on that side.

To avoid further trouble of a like nature, and in an effort to get more work out of the press than had hitherto been done, the carriage shown in the cut was built and used as a permanent fixture. The table of the carriage was nearly as large as the base of the press, being 30 in. x 30 in., and was mounted on four V-grooved wheels, these wheels running on steel angles with the corner turned upwards. An adjustable screw stop was provided at the back to limit its motion as desired. The table was provided with T-slots for attaching the various jigs and fixtures used.

Two men were hereafter employed on the press and considerable time was saved by this method. The carriage would be drawn back by the helper entirely clear of the press, the tracks being supported at the outer ends by standards attached to the floor. As most of the work consisted of drilling the flanges of cylinders, bases, etc., the work most common for this kind of a machine in a gas engine shop, plugs or other simple locating fixtures were attached to the table of the carriage so that the castings could be easily and quickly located by the helper. The table was also at such a height as to enable a man to easily set a casting thereon without stooping to any great extent. The helper then shoved the carriage under the press and up against the stop, having previously placed the drill jig in position on the piece.

The press operator now proceeds to the drilling, he practically taking care of but this one operation. In returning the drill head, it is only necessary to get the drills just far enough out of the work to clear the jig, when the carriage is pulled back and re-loaded. It will be seen that there is thus no locating to be done. The production of the machine was more than doubled through the use of the carriage, and the machine was left running continuously, no time being lost in stopping and starting, and there was no danger to either the operator or helper as before. Before the carriage was added, trouble was always experienced in getting the men to handle the machine as they were always afraid of getting caught, but they afterwards seemed to enjoy operating it, cutting down as it did a great deal of the laborious operation.

Were it justifiable by the amount of work the track could be placed entirely across the machine table in the opposite direction, two carriages being used as well as two helpers, one on each side of the machine. As one carriage was withdrawn, the man on the other side would shove his carriage, already loaded, under the press, and while the drilling was being down on this, the first carriage would be loading, and shoved under as the first was withdrawn. By using two carriages and two helpers, besides the regular operator, the production of the machine could be practically doubled over the arrangement here shown, as the machine could then be kept drilling almost continuously, the only limiting condition being the ability to get the work under the press fast enough.



AN ADDITION TO THE MULTIPLE.

TENSION ON CYLINDER COVER STUDS.

By A. E. W.

IN the February 5 issue of **Canadian Machinery** there appeared an article under the above heading, by J. H. Rodgers, in which the old question is raised of whether the tension in cylinder cover studs is increased when steam is admitted to the cylinder.

It is generally agreed that with a metal-to-metal joint no increase in the tension on the studs takes place until the force tending to separate the cover from the flange exceeds the initial tension in the studs due to the screwing up of the nuts. If, on the other hand, an elastic packing be inserted in the joint, the tension on the studs is equal to the initial or "screwing-up" tension, plus the tension due to the steam pressure. This second conclusion is correctly arrived at by Mr. Rodgers, and is illustrated by his Fig. 8. His Fig. 1 also shows conditions as they are, but he makes the mistake of saying that if the weight on the cover were only 10 lbs., the stress on the studs would be 1,005 lbs.

In order to secure a steam-tight joint it is, of course, necessary that the cover and flange be made thick and rigid. When the cover and flange are pressed together, metal-to-metal, they are much more unyielding than the studs or bolts. If the flange and cover are assumed to be so heavy and rigid that they cannot be compressed at all, the studs are practically springs, and, in order to produce in them a tension higher than the initial tension, a force must be applied to the cover sufficient to separate the latter from the flange.

Referring to the accompanying Fig. 1, let it be assumed that each nut is screwed up so tight that its stud is elongated 1-1000 inch, and, in order to use the same figures assumed by Mr. Rodgers, we will suppose that this elongation produces a stress of 1,000 lbs. in each stud. The cover is thus pressed upon the flange with a force of 1,000 lbs. for each stud. Only two studs, as seen

in the figure, need be considered. We have then a force of 2,000 lbs. holding the cover to the flange.

If a weight of 800 lbs., as shown at (A), be now placed on the cover, it is obvious that no extra stress is set up in the studs. For they cannot be stressed beyond 1,000 lbs. without being at the same time further elongated, and they cannot be further elongated unless we separate the cover from the flange, to do which will require a force of slightly

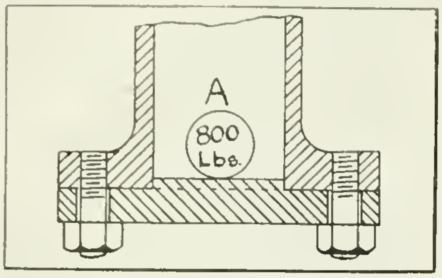


FIG. 1. TENSION ON CYLINDER COVER STUDS.

over 2,000 lbs. The only effect of the weight (A) is to reduce the pressure between the cover and the flange by 800 lbs. If, however, the weight (A) be increased to 2,000 lbs., the studs will be stretched a further 1-1000 inch, and the joint will open. This result has been embodied in the following rule:—

When the bolt, or stud, is more elastic than the material it compresses, the stress in the bolt is either the initial stress or the force applied, whichever is the greater.

The Elastic Joint.

Next consider the conditions existing when a packing or gasket is introduced at the joint, as shown at (B), Fig. 2. In such a case, it is the packing rather than the stud that is elastic. Let us assume that the studs are again stressed to 1,000 lbs. each, and that this compresses the packing 1-100 inch. If now the weight (C) of 800 lbs., as before, be applied, the studs will be stretched an inappreciable amount compared with the

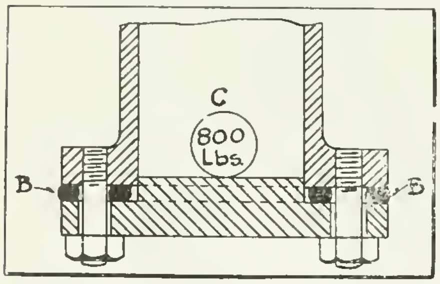


FIG. 2. TENSION ON CYLINDER COVER STUDS.

amount the packing has been compressed. The result is that the packing will be pressed against the flange with practically the same force as before, and the only effect of the weight (C) is to increase the stress in each of the studs by 400 lbs. In other words, the stress in the studs is the initial stress, plus the stress due to the force tending to separate the cover from the flange. Hence the second rule:—

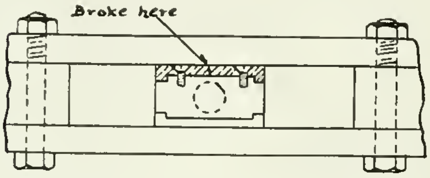
When the material compressed is more elastic than the stud, the stress in the stud is the sum of the initial stress and the force applied.

REPLACING CROSSHEAD LINER.

By R. Bell.

ON an engine of the double bar type there were brass liners fixed to each side of the crosshead shoes. These were secured by means of ⅝-in. countersunk headed screws, and further held in place by a shoulder at each end as shown in sketch. One of these liners got working loose, and eventually broke in the middle, so it had to be replaced, being unsafe. A very quick and effective repair was made as follows.

The top guide bar was taken off and the liner removed. The guide block was cleaned properly and then replaced. The engine was next turned over until the crosshead stood in the narrowest part of the guide bars, these being



REPLACING CROSSHEAD LINER.

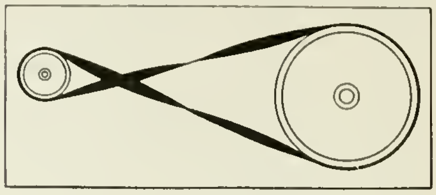
worn a little in the centre. The open edges were then boxed up with wood and all small spaces filled with clay, provision being made for a runner to allow the babbitt to be poured in. The space formerly occupied by the liner was now filled with babbitt, boxing removed, a liberal supply of valve oil applied to the guide bar and the engine started up. The result was a first-class job started and completed during the lunch hour.

I am of the opinion that babbitt might be used more extensively than it is for repairs such as the above-mentioned. It makes a substantial and satisfactory job, does away with all machining.

RUNNING A CROSSED BELT.

By J. E. McCormack.

WHEN running a crossed belt on two pulleys, one of which is only one-third, more or less, the diameter of the larger pulley, try putting the belt on the smaller pulley first; then, after crossing it, turn the remaining loop inside out, other side to the pulley, before placing it on the latter. This belt will now scrub its edges less than if put on in the usual manner. Of course, as one side comes in side comes in contact with the other pulley the joint must be laced or fastened accordingly. The foregoing method will



RUNNING A CROSSED BELT.

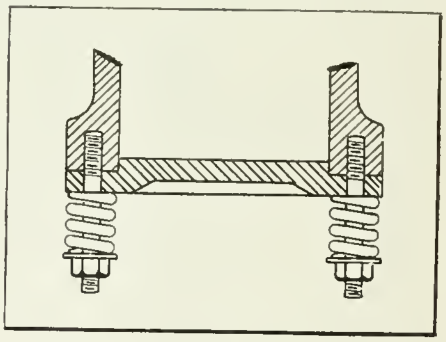
not apply when the difference in the pulley diameters is comparatively small.

STRAIN ON CYLINDER HEAD STUDS.

By H. Westwood.

AS this is a question about which there ought not to be any difference of opinion among engineers, and as there is some danger that some who ought to understand it, may not consider it worth their while to figure it out, I beg to submit the following explanation:—

Assume that ten studs securing a cylinder head to the cylinder are long enough to permit a heavy coil spring on each one in such a way that one end of it will press against the outside of the cylinder head, and the other end against a washer placed between it and the nut on the stud. If the nuts be now screwed up, so that each spring is under a tension of say 1,000 lbs., there will be a total pressure of 10,000 lbs. against the head tending to hold it up to the end of the cylinder. As the springs will exert an equal pressure in both directions, there must be a tension of 10,000 lbs. on the studs. It will now be readily understood that all the strain there is on the studs is that due to the action of the springs, and that this cannot be increased except by further compression of the springs. This can be done from the inside of the cylinder by turning on the steam and as soon as the pressure



STRAIN ON CYLINDER HEAD STUDS.

rises in the cylinder there is certainly more stress on the studs by further compression of the springs, thereby forcing the head away from the cylinder and shortening the distance between

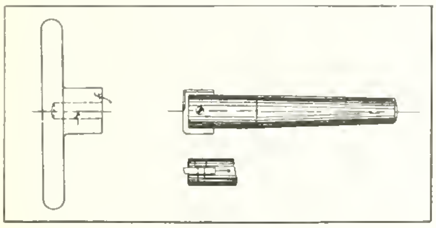
the cylinder head and the washers under the units.

To those who find this proof convincing, it may be well to suggest that the part performed by the springs in this particular case is ordinarily taken by the elasticity of the studs which act precisely in the same manner, and it may be well to say further that the above action in regard to bolt strains, is not confined to cylinder head bolts only, but is true in all cases where a bolt or a stud is subjected to tensile strain.

FINISHING HAND WHEELS.

By D. A. Hampson.

ONE of our shop products was a hand-operated machine which had an adjustable guide operated by a 15-in. hand wheel of the design shown in the figure. These wheels came to us from the foundry with solid hubs. They were put in a four-jaw independent chuck, trued up, centred, drilled, bored, and the ends faced off—all in the short space of an hour apiece. Sometimes twelve were required and sometimes twenty-four, but the conditions were such that it was not advisable to make a large number of the wheels at a time, and, under such conditions, it had always been considered that the resultant high cost of finishing the hand wheel was a thing that had to be endured.



FINISHING HAND WHEELS

I was put on the job which included among other things the finishing of these wheels, and, by dint of some hustling, managed to turn them out in an average of 45 minutes. After one lot went out, I requested permission to "tool up" a little for the next, but was informed that it wouldn't pay. In the end I was told to "see what I could do for $5."

First I took a blank casting, turned the rim and the hub, and filed it up nice and smooth. The patternmaker added a core print and made a core box to give us a cast hole 1/8 in. smaller than the machined size, and with a blind end—which was the way all the wheels were used. I was then sure that the castings would come round and that I could use a universal chuck, which would save the truing-up time.

A piece of mild steel was turned up to fit the tail-stock, and having an extended end of a length equal to the core in the hub. This end was slotted and split, and fitted with a binding screw. Two blades were made for the slot of 5-16 in. x 1½ in. tool steel—one a thirty-second longer than the other. One blade was to be a rougher for the hole and the other a sizer. These tools are shown in the drawing—to a larger scale than the wheel.

When the next lot came in, I put on the chuck and gripped a wheel. It centred very closely and did not need changing. Then, with a tool I faced off the end of the hub and locked the carriage so that all the wheels would be alike and with no new setting of tools. With the hand feed on the tail-stock, the roughing cutter was run to the bottom of the hole and then changed for the finisher. This one demanded a little shifting of the tailstock to bring the cut to size, but once set it was set for all. I then got hold of Jimmy, the apprentice, and coached him on the job. After he had done two or three, he became expert, and finished the remaining twenty in 4½ hours. It will be seen, therefore, that the $5—it had amounted to $6—was not going to be long in paying for itself.

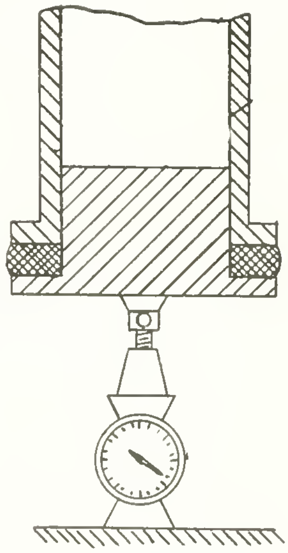
TENSION ON CYLINDER COVER STUDS.

By R. Bell.

I READ with interest the article, entitled "Tension on Cylinder Cover Studs," by J. H. Rodgers, in the Feb. 5 issue of **Canadian Machinery**.. From such articles there is certainly a great deal of benefit to be derived, and especially by us in the outlying districts of this western land, where we are out of reach of technical schools and other such excellent institutions.

While the answer may seem very clear to each of us, whatever may be our opinion, still there is always the other side to consider, and, in doing so, we may have to hunt out some of our old text-books, which may have the dust of years on them, though they ought not to have; and, although we may not get any new light on the point at issue, still we are the gainers by having considered two sides of some problem, which, perhaps, never before crossed our minds. Could we but have some such question brought before us each week and debate it out in our own minds or with our fellows, many a man would get out of the rut and become a thinker instead of a mere machine.

With regard to the question raised, I am of the same opinion as Mr. Rodgers. The pressure on the studs does increase, and the figures shown in the article demonstrates to my mind quite clearly the conclusions arrived at. I reason it out in this manner. The sketch shows a cylinder and cover which, for the sake of demonstration, is made so that the cover is free to move through a certain distance. The spigot of the cover goes well into the cylinder, and is steam-tight where it fits into the cylinder. There is further a compressable joint between the cylinder and cover. The area of the cylinder is 100 square inches. Suppose the cover, instead of being held in place by studs, to be blocked up by means of a strong steel balance and have pressure applied by a screw jack interposed between the balance and cover until the balance shows 10,000 lbs., being the pressure mentioned in the original question raised by Mr. Jones; in other words, ten



TENSION ON CYLINDER COVER STUDS.

studs screwed up to a tension of 1,000 lbs. each.

Now, I hold that for every 1 lb. per square inch of steam pressure admitted to the cylinder the balance will show another 100 lbs. The pressure mentioned in the question is 80 lbs. per square inch, and this on an area of 100 square inches would be $100 \times 80 = 8,000$ lbs. Our balance at this pressure would, therefore, register $10,000 + 8,000 = 18,000$. The balance is taking the place of studs in this experiment, and if the balance indicates this extra pressure, why should the studs likewise not receive it?

With regard to the question raised by Mr. Orr: "Does the pressure of steam against the inside of a cylinder cover lessen the screwing-up presure with which the studs hold the cover against the cylinder end?" I should say it certainly does, and that pressure reaches zero when the pressure exerted on the inside of the cover is equal to the total tension on the studs holding the cover in place. The tensile strength of the studs, of course, continue to hold the cover in place after that point is reached.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rogers

Doubtless some of the elementary work in the first few articles of this series may appear more or less superfluous, but it must be remembered that numerous simple rules and formulae appear from time to time in Technical Journals, which are discarded and dubbed impractical by many operators for the simple reason that the elementals are either unknown or have been forgotten. The purpose of this course will have been achieved if the above tendency is even in part combatted.

INTRODUCTORY.

It seems to be the unversal opinion among a great number of present-day mechanics and apprentices, that the use of figures or a general knowledge of advanced arithmetic should belong to the man higher up, the foreman, superintendent, or draughtsman.

While, to some extent, the present methods of modern manufacture, especially in large establishments, tends to eliminate from the average workman one of his greatest assets, that is, the mental faculty, which enables him to see and do things before they are actually performed, there should be no good reason why the workman, to some extent, does not become conversant with the theoretical portion of his daily labors. Some men may argue that the use of mathematics in the shop is of little importance to the average man or boy employed at the bench, on the machine, or in the power plant.

This reasoning may hold good if the man or boy has become content to remain at his present level for all time to come; but, to the ambitious person who is desirous of climbing farther up the ladder, it behoves him to fit himself to the duties of the rung above that on which he is standing. How often do we hear the remark? "He's a lucky guy," when the more reasonable view to take would be that of asking the question, "Is he a lucky guy?"

While luck or pull may have something to do with the advancement of a few, it is generally the ability of the person that secures for him the position. and his fitness that keeps him there. Few, if any, of us, would proceed very far if we were to wait and let someone push us into one of these "lucky" jobs. Although it is true, that the wheels of industry to-day are kept in motion largely by the strength and energy of men of muscle, it remains an unquestionable fact that these same wheels were first put in motion by men of brains.

Where would the steam engine of today be had it not been for the active mind and reasoning faculty of Watt and Stephenson?

What would the world be deprived of to-day, but for the discoveries by scientifically applied thought of such men as Franklin, Volta, Faraday, Ohm, and Ampere, and the ever-planning of Edison and Marconi?

When the identity of lightning and electricity was discovered by Benjamin Franklin, people asked, "Of what use is it?" The retort of the great philosopher was, "What is the use of a child? It may become a man." Many great revolutionary projects of to-day had apparently very insignificant beginnings, and the same may prove true of many men and boys whose only ambition seems to be to fill in the few hours that they spend in the factory.

Problems of the Daily Task.

Granting that the use of higher mathematics may be the special duty of more learned men than those usually found in the workshop, there are still many problems that the mechanic meets in his daily labors that could be more intelligently handled than at present if a general knowledge of the art of figuring was better understood by those called upon to face these questions.

Many of these shop problems, if given to the average boy just after leaving school, could be correctly solved, but the fact that the young men of today usually spend a year or more after leaving school before they settle their minds to the adoption of a trade leaves time enough for their brains to become rusty. Even polished steel will become oxidized if care is not taken to retain the surface of the metal.

Of what use is the knowledge we received while at school if in after life we do not take advantage of it when the occasion demands? Many workmen who are capable of solving a written question in certain lies of mathematics seem unable to grapple the same problem when met in a practical way in the shop. The study and application of calculation to practical problems in the shop exerts an influence in broadening the mind, and often keeps a person from becoming an automation or human machine.

This course of lessons in practical shop arithmetic while intended for those not conversant with the application of the principles of mathematics as applied to shop problems may also prove of some interest and help to those who to some extent are accustomed to using calculations in their daily efforts. In outlining the lessons, it will be assumed that the readers are familiar with the four elementary principles of arithmetic, namely: addition, subtraction, multiplication, and division as taught in the public schools. As far as possible the problems and solutions will deal directly with practical work, so as to appeal to the average man or boy working in machine shops, power plants, and engineering works, generally.

Throughout the course, many formulae will be necessary, but those who are not familiar with this branch of mathematics should have no scruples about using them, as they are only a short method of expressing a rule, and a little study on the part of the average man or boy will make them sufficiently proficient to understand those met with in this series of shop lessons.

Arithmetical Axioms.

Arithmetic is the art of reckoning or study of numbers.

Addition is the process of finding the sum of two or more numbers. The sign of addition is $+$ (plus). The sign of equality is $=$ (equals); thus, $9+2=11$ would read nine plus two equal eleven.

Subtraction is the process of finding the difference between two numbers. The sign of subtraction is $-$ (minus); thus $40-15=25$, and reads forty minus fifteen equals twenty-five.

Multiplication is the process of multiplying one number by another, or adding one number to itself a certain number of times. The sign of multiplication is $\times$ (times or multiplied by); thus, $25\times5=125$ reads twenty-five times five equals one hundred and twenty-five. Again by addition, $25+25+25+25+25=125$.

Division is the process of finding how many times one number is contained in another. The sign of division is $\div$ (divided by); thus, $42\div7=6$ reads forty-two divided by seven equals six.

Chart (1) illustrates the position and names of the various terms used.

Cancelation.

Many calculations in multiplication and division can be considerably shortened by cancelation, or the casting out of equal factors from both dividends and divisor.

The factors of a number are those numbers which, when multiplied together will equal that number; thus 12 and 6 are factors of 72 since 12×6 =72.

Canceling equal factors from both divisor and dividend does not alter the quotient. Thus, dividing each term of the fraction 48/64 by 4 we get 12/16; again dividing each term by 4 we have ¾. When canceling, be sure and remove an equal factor from both terms of the fraction. Example:—

Divide 18×15×24 by 5×36.

Solution:

$$\frac{\overset{1}{\cancel{18}}\times\overset{3}{\cancel{15}}\times\overset{12}{\cancel{24}}}{\underset{1}{\cancel{5}}\times\underset{\underset{1}{\cancel{2}}}{\cancel{36}}}=\frac{1\times3\times12}{1\times1}=\frac{36}{1}=36$$

Explanation:—The 5 in the divisor and the 15 in the dividend are both divisable by 5, as 5÷5=1 and 15÷5=3. Again 18÷18 = 1, and 36÷18 = 2. Further, 2÷2 = 1 and 24÷2 = 12. The cancelation being complete leaves the relation of the dividend to the divisor the same as before, but much simplified. Multiplying the remaining factors in both terms, we have 1×3×12=36 and 1×1=1; then 36÷1=36.

To avoid confusion, always cross out or cancel the factor affected by the process of the division. It is usual to omit the 1 when a factor is being divided by itself, as:

$$\frac{3}{6}=\frac{\cancel{3}}{\underset{2}{\cancel{6}}}=\frac{1}{2}$$

Example, see Chart 2.—An emery wheel is required to have a speed of 2,200 r.p.m. The main shaft has a speed of 185 r.p.m., and diameter of pulley on work shaft, W.S.=4 inches. Assuming we have pulleys for counter-shaft of 24 inches and 15 inches diameter, find the main-shaft.

In problems of this nature the speed of the driving shaft multiplied by the diameters of all the driving pulleys will equal the speed of the driven shaft multiplied by the diameters of all the driven pulleys, or expressed in the formula, Chart 2.

Revs. of M.S. × Dr. = revs. of W.S. ×Dn., or

$$\text{Revs. of W.S.}=\frac{\text{Revs. of M.S.}\times\text{Dr.}}{\text{Dn.}}\text{, then}$$

diameter of driving pulley on main-shaft

$$=\frac{\overset{\overset{1100}{\cancel{1100}}}{\cancel{2200}}\times\overset{3}{\cancel{15}}\times4}{\underset{37}{\cancel{185}}\times\underset{\underset{2}{\cancel{6}}}{\cancel{20}}}=\frac{1100}{37}=29\frac{27}{37}\text{ ins or}$$

say, a 30 in. pulley.

Fractions.

A common fraction is a certain part of a whole number.

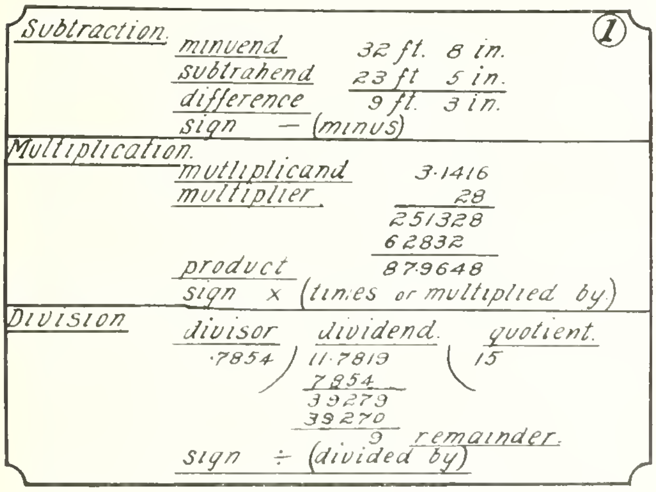
The terms of a fraction are the numerator and the denominator.

The value of a fraction is the numerator divided by the denominator.

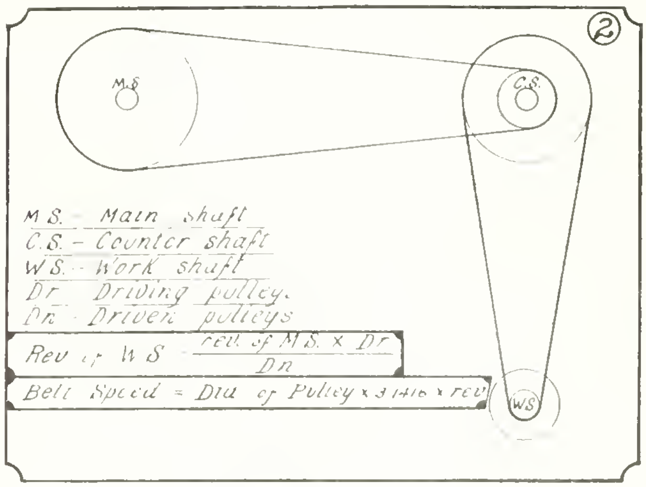
To accomplish this, we place the denominator in a row, thus

8	4	16	2	64	100
			2	32	50
				16	25

If any of these numbers are contained equally in one or more of the others, it may be eliminated, thus, four goes into 8, therefore, cancel 4. Eight goes into 16, therefore, cancel 8; sixteen goes into 64, therefore cancel 16. This leaves 64 and 100. Now, 64 will not go into 100; but we see that there are still factors of both numbers that are common to each other. To eliminate these, we proceed as follows:—Divide both numbers by a prime number; in this case 2. We get 32 and 50: Again, dividing by 2 we get 16 and 25. Now, these numbers, 2, 2, 16 and 25 when multiplied together will give what is known as the Least Common Denominator.



ARITHMETIC CHART 1.



ARITHMETIC CHART 2.

A fraction may be changed to higher terms of the same value by multiplying both terms by the same number; as ⅜ to twenty-four sixty-fourths. Multiplying each term by 8 we get 3×8=24, and 8×8=64, therefore ⅜=24/64.

Also, to change to lower terms having the same value, divide, if possible, each term by the same number.

To reduce a fraction to an equal fraction having a given denominator. Divide the given denominator by the denominator of the given fraction, and multiply both terms by the result. Thus ⅞ to thousandths. Then 1000÷8=125, and multiplying both terms by 125, we have 875/1000.

In addition and substraction of fractions, the fractions must be changed so they will have a common denominator. Thus, it would not be convenient to add ⅜, ¾, 7/16, 33/64 and 35/100. We must change them to fractions of the same value but with a common denominator.

Addition of Fractions.

When changing to fractions having the least common denominator, write the sum of all the numerators over the common denominator, and, if necessary, change to a mixed number.

Subtraction of fractions.

When changing fractions to other fractions having a common denominator, subtract the numerators as is done in whole numbers and place the difference over the common denominator.

Multiplication of Fractions.

In multiplication of fractions, it is not necessary to use a common denominator. Divide the product of the numerator by the product of the denominators. All factors common to both terms should first be cast out by cancelation. When mixed numbers are involved, first change them to improper fractions; and if the answer is an improper fraction, change to a mixed number.

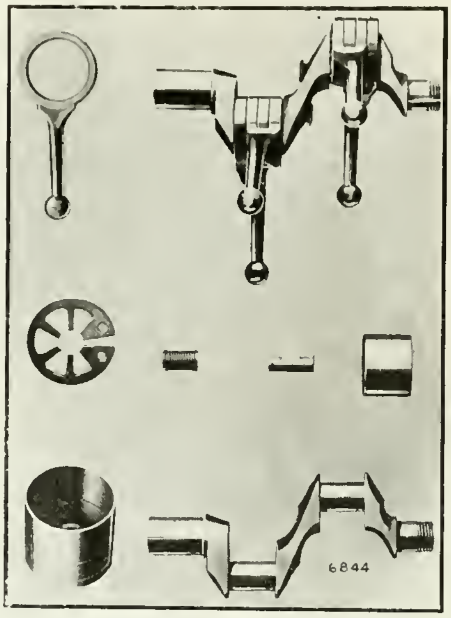
DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

ROLLER BEARING PNEUMATIC DRILL.

THE noteworthy recent advance in the pneumatic tool line is the improved "Little David" drill which was brought out a short time ago by the Canadian Ingersoll-Rand Co., of Montreal, and the Ingersoll-Rand Co., of New York and London. This is claimed to be the only drill on the market having connecting rods running on roller bearings combined with crank shafts running on ball bearings. In addition, the new tool has all the advantages of the previous type, such as unusual accessibility to all parts, absence of peined and hinged joints on the connecting rods, and cylinder heads cast integral with the drill casing.

The fewness of parts and general simplicity of the tool are striking features. The shell is so designed that the entire motor apparatus may be assembled or disassembled through the crank case by the removal of the cover. The motor or engine is of the angular, four-cylinder, single-acting, reciprocating piston type, each pair of pistons being attached to opposite throws of a double crank shaft, and each acting in balance. All four connecting rods are exactly alike and are interchangeable. Each consists of but a single part made by drop-forging a piece of selected steel. The connecting rods run on Hyatt roller bearings. The connecting rods are attached to the pistons by ingenious spring arrangements, whereby ease of assembling is secured. The piston ends of rods are ball shaped, over which the flat steel springs are slipped. These balls have their bearings in the centre of the pistons, forming ball and socket joints, permitting the connecting rods to yield to pressure from any direction without causing the pistons to bind in the cylinder. This construction also permits the pistons to turn in the cylinders so that wear is evenly distributed.



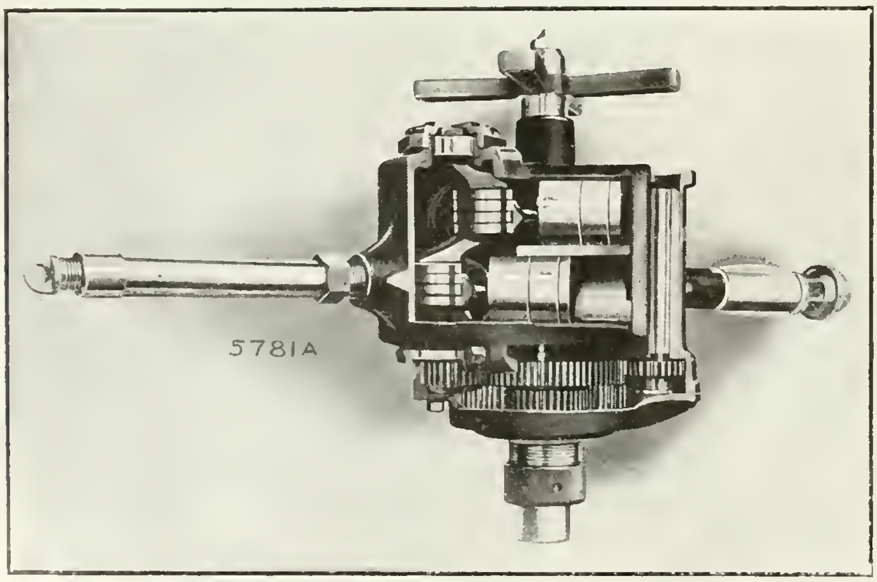
ROLLER BEARING CRANK AND CONNECTING RODS.

The crank shaft works in F. & S. silent-type ball bearings. These are of the separator type, which is claimed to be superior to the full type of bearing for machines of this character operating at medium and high speeds, as, in the full type of construction, the balls come in contact and wear flat rings on their circumferences in very short time, resulting in loose bearings and generally unsatisfactory operation. This rapid wear is largely due to the fact that the balls are rotating in opposite directions at their points of contact, and the wearing effect is therefore doubled.

The spindle is provided with a ball thrust bearing interposed between the shell and feed spindle in such manner that the main frame is relieved of all thrust or strain. Each valve controls two pistons which act on alternate strokes. The valves being completely balanced and of the rotating type instead of reciprocating, wear is equalized. The valves are geared to the crank shaft through the medium of a spindle gear. The valves are geared to the crank shaft ground, operating in bronze bushed chests, giving a combination of two ideal wearing surfaces. The setting of the valves is simple, it being merely necessary to see that the letters stamped on the valve and crank shaft pinions register with letters on the main gear. With the exception of the valve bushings, all parts subject to wear and strain are made of special steel, hardened and ground to close working fits, designed to secure the utmost lightness, consistent with ample strength.

These tools may be made reversible or non-reversible at the will of the operator, this being accomplished by changing the position of a sliding sleeve on the throttle handle. With the exception of the light wood-boring type, all sizes are provided with compound gearing, insuring great power at all speeds.

The "Little David" drill is made in five sizes. No. 1 is for heavy drilling, reaming, tapping and flue rolling. No. 2 is for similar work of a lighter nature, while No. 3 is for light drilling and reaming. The No. 12 size is fitted with a chuck for a 4-in. wood-boring auger, and the No. 13 size has a chuck for a 2-in. wood-boring auger.



ROLLER BEARING PNEUMATIC DRILL PARTLY IN SECTION.

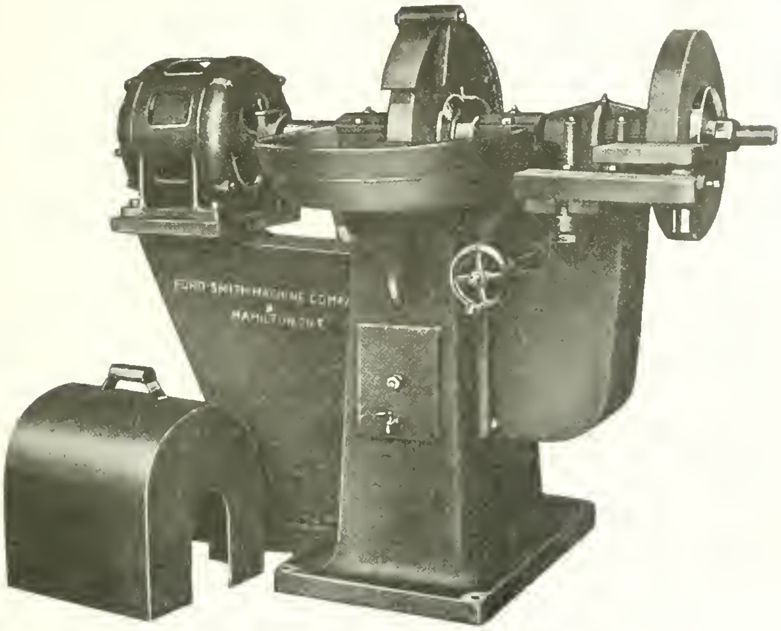
The Pratt & Whitney Co. of Canada, Employees, held their annual banquet on the 6th of February at the Central Hotel, Dundas, Ont. A very enjoyable evening was spent, consisting of songs and instrumental music by various members of the staff. The proceedings were ably presided over by Mr. W. H. Tims, the factory superintendent.

MOTOR-DRIVEN GRINDERS.

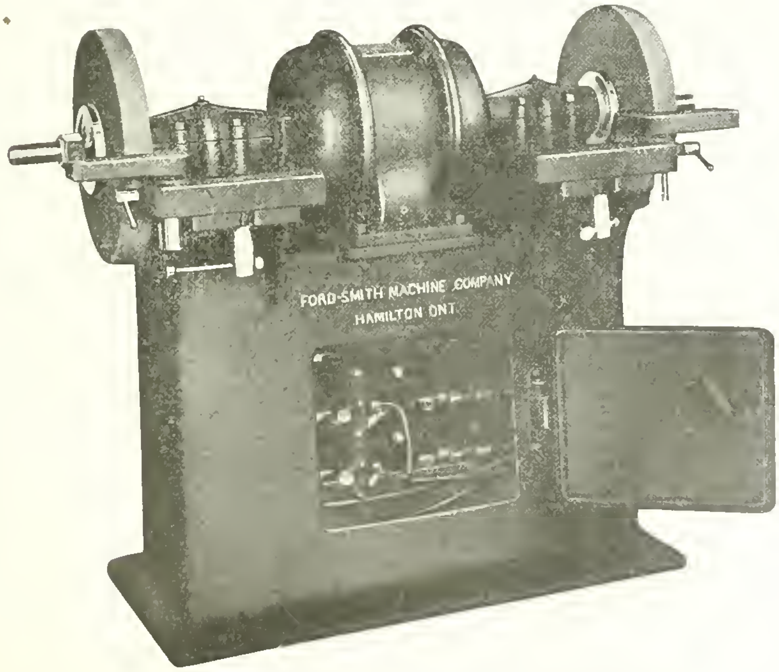
TWO interesting types of motor-driven grinders for general purposes, such as foundries, machine and railroad shops, are here illustrated. These grinders are standard types, and are manufactured by the Ford-Smith Machine Co., Hamilton, Ont. The advantages of a motor-driven grinder is that it dispenses with the need of high-speed countershafting, and can be placed in any convenient position in the shop to suit both the light and other work for which its service is required. Especially is this true of foundries and erecting floors where line shafting is often not installed, and also where the service is intermittent.

The 16-inch motor-driven floor grinder shown in the illustration is built in sizes to take wheels from 10 to 30 inches diameter. This machine is of heavy construction, rigid and compact, being equipped with rests of ample strength, and convenient of adjustment by vise handles, thus doing away with the need of wrenches. The ring oiling bearings are adjustable for wear and of ample length, and are also furnished with felt dust-proof washers. The spindle is of special steel, and can be renewed when worn without interfering with the motor. It is fitted with adjustable locking nuts for taking up the end wear. The motor is fully enclosed, pipe ventilated to the base, and is specially designed for this class of work. It is built either for a.c. or d.c. current, and has a large margin of power for the service required. The switch gear is of the "ironclad" type, and is located inside the box body, access being obtained by opening the door.

The motor-driven wet and dry grinder is of similar design, with the exception of the location of the motor and the addition of the water tank and bowl. The motor in this case is only partially enclosed, but is fitted with a detachable hood for protection against water or dust. This type of grinder is made to take wheels up to 36-inch diameter. Both types of grinders are usually fitted with the Ford-Smith safety collars and steel protection hoods.



COMBINATION WET AND DRY GRINDER.



16-INCH MOTOR-DRIVEN FLOOR GRINDER.

RECORD IN BUILDING LARGE ENGINES.

WHAT is believed to be the world's record in constructing engines was recently accomplished by the Mesta Machine Co., of Pittsburg, Pa., in building two horizontal cross compound blowing engines for the Woodward Iron Co., Woodward, Ala. The first engine was completed and loaded on board cars at the Mesta Works in 38 days, and the second one in 59 days from the date of signing the contract at Woodward, Alta. Each of these engines embraces one high pressure steam cylinder, 48 inches in diameter, one low pressure steam cylinder 84 inches in diameter, and two air cylinders 84 inches in diameter, with a stroke of 60 inches.

The Woodward Iron Co. had installed two large turbo blowers to furnish blast for their new 500-ton furnace, recently completed. These blowers were in operation for about a week, only, when both were wrecked. It was then decided to replace them by reciprocating steam engines. After investigating different types, they decided on horizontal cross compound steam engines. Quick delivery was of course all important.

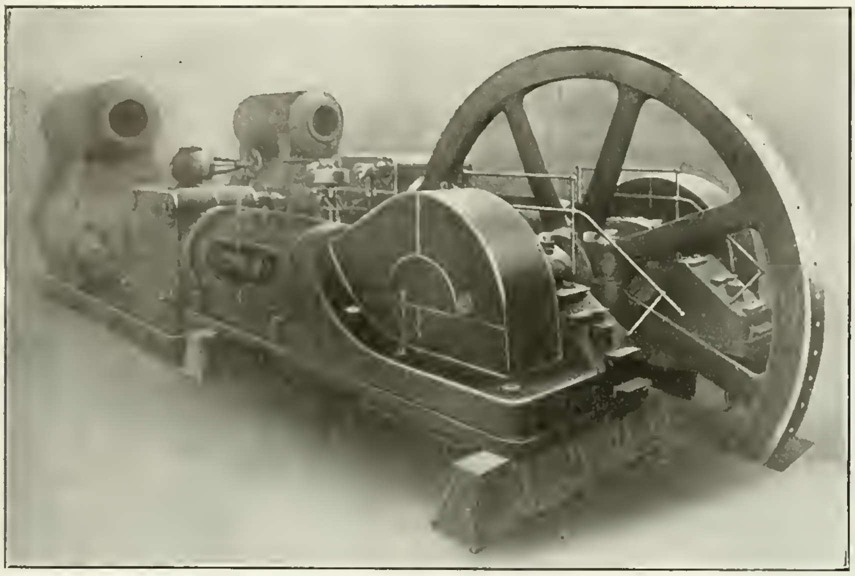
The Mesta Machine Co. offered their new type of horizontal cross compound blowing engine, equipped with the Iversen patent automatic plate valves, and agreed to deliver the first engine on board cars at the Mesta Works in 90 days and the second engine in 120 days. On November 15, 1913, a contract was signed for two of these engines, with delivery as stated above, a bonus and penalty clause being included.

The magnitude of the task is better realized by a statement showing the work handled. The engines weigh 1,800,000 lbs., and contain 10,210 pieces.

The lightest piece weighs one-fourth of an ounce, the heaviest piece 94,550 lbs.

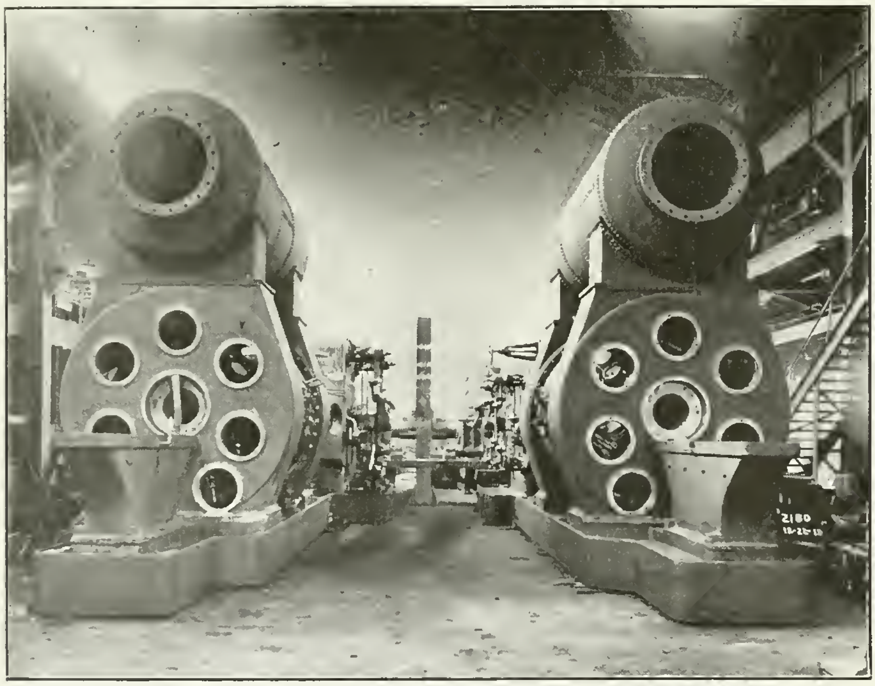
Description of the Engines.

The engines are of the horizontal cross compound type, with the air large receiver is placed over the air cylinders, which practically eliminates vibration in the air lines to the furnace. The engines are designed for 30 lbs. air pressure and to run at a speed of 80 r.p.m.



48-84-84 IN. X 60 IN. CROSS COMPOUND BLOWING ENGINE ON ERECTING FLOOR.

cylinders placed directly back of the steam cylinders. Both the high and low pressure steam cylinders are equipped with Corliss valve gear and the air end with Mesta (Iversen Patent) automatic inlet and outlet valves. These valves require no valve gear, and allow the air



AIR RECEIVERS AND AIR CYLINDER ENDS 48-84-84 IN. X 60 IN. CROSS COMPOUND BLOWING ENGINE.

cylinders to be placed directly back of the steam cylinders. This same arrangement is used also in the design of Mesta gas driven blowing engines. A

IMPROVED MEASURING TAPES.

MEASURING tape cases in use are of various construction but in a general way it is true that until now the superior features of a steel case liner for leather cases and a push button opener for winding handles have been embodied only in the very highest priced steel measuring tapes. The Lufkin Rule Co. of Canada, Ltd., Windsor, Ont., announce that they have now added these improvements to their general line of steel tapes and without advance in price.

"Challenge" and "Challenge Junior" steel tapes now have leather cases steel lined throughout. This gives extraordinary stability. The case is also narrower than before by a full ⅛-inch, hence a neater appearance, more compactness. The cases now have also a positive action push button opener of new design for the winding handle.

"Rival" and "Rival Junior" steel tapes have nickel-plated steel cases as before, but are now also equipped with a positive action winding handle opener like the "Challenge" and "Challenge Junior" mentioned above.

UNIQUE POWER PLANT FOR FORD MOTOR CO.

THE Ford Motor Co., says the Iron Age, has placed contracts for a gas engine-electric power plant that will be not only one of the largest in the country, but in many respects altogether unique. The Company has appropriated in the neighborhood of $1,000,000 for the project, which will put into effect plans Henry Ford has long had in mind for utilizing the waste heat of the ordinary producer gas engine.

Four 6,000-h.p. Hamilton-Gray gas engines of novel design will drive the same number of Crocker-Wheeler 3,750-k.w. 250-volt 80 r.p.m. engine-type direct-current generators, but one pair of cylinders will be operated by producer gas and the other by steam. The steam will be generated from the water used in the water jacket of the gas engine, further heated by the exhaust gases and by waste heat from the producer gas plant. This water or steam will be used as the feed water for the boiler which supplies the steam engine cylinders. A heavy flywheel will equalize the characteristics of the gas and steam driven elements of the engine. Each of the generators will have a normal rating of 3,750 k.w., the largest capacities on record for generators of this type. Each engine will appear as a cross-compound engine with two cylinders in tandem on each side.

Kelly Floating Reamers Going Abroad.—Through its English agents, C. W. Burton, Griffiths & Co., London, E.C., the Kelly Reamer Co., Cleveland, received on February 10, a $1,200 order for Kelly-Adjustable-Floating Reamers and Boring Tools after three months' trial by a large English manufacturer, who finds that the "Floating Reamer" eliminates "grinding."

ASSOCIATION AND PERSONAL

A Weekly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Machinery Circles

W. F. Vilas, of the Vilas Implement Works, has been re-elected Mayor of Cowansville, Que.

J. Lanning, B.A.Sc., has been appointed a superintendent in the smelter works of the Mond Nickel Co., at Coniston, Ont.

J. E. Long, safety engineer, Montreal, has been engaged to inaugurate a "Safety First" system on the Intercolonial Railway.

Arthur W. White, London, was elected to the presidency of the London Canadian Club at the annual meeting last Thursday evening.

John S. Dickson, of the firm of Dickson Bros., bridge builders, Campbellford, Ont., was found dead on the G.T.R. line, near Belleville station, last Friday.

Kenneth Morrison, at the head of a new company who will erect a nail plant on Lulu Island, B.C., was formerly mechanical superintendent for the Dominion Iron and Steel Co., Sydney.

W. E. Woodhouse, late assistant superintendent of motive power, C.P.R. western lines, has been appointed superintendent of motive power with offices at Montreal.

Thomas Watson, manager of the Wind Motor Co., Woodstock, Ont., will be general manager of the Concrete Machinery Mfg. Co., Woodstock, which is an amalgamation of the above plant with the Mitchell Crusher Mfg. Co., Toronto.

George Minorgan, who with his two sons, has taken over the foundry formerly run by the Reid-Easby Co., at Beaverton, Ont., has for upwards of thirty years been foreman of the implement and machine works of Peter Hamilton, Peterborough.

W. St. H. LeSueur, for the past year and a half advertising manager for the Tudhope-Anderson Co., Orillia, Ont., has severed his connection with that firm, and left last week for Berlin, Ont., where he has accepted a similar position.

Jeffrey G. Omnanney has been appointed special engineer to Sir Thomas Shaughnessy, of the C.P.R. The notice of his appointment states that he will perform such duties as might be assigned to him from time to time by the president.

Hon. N. Curry has joined the board of the Halifax Tramways Co.

V. G. Curry, vice-president of the Canadian Car and Foundry Co., was in Brantford last week.

W. A. Gerolamy, Tara, Ont., who formerly conducted an extensive foundry business, died here last Thursday, aged 82.

WHO'S WHO?

C. M. MURRAY.
Sales Manager, Chapman Double Ball-Bearing Co., Toronto.

George T. Clark, city engineer, of Saskatoon, until a short time ago, has entered the firm of Western Pavers, Ltd., and will take charge of constructional work for this company in Western Canada.

Daniel Knechtel, president of the Knechtel Furniture Co., Hanover, Ont., narrowly escaped death last Thursday, when a steam pipe extending from the boiler to a machine used for bending steamed wood exploded. The machine was wrecked and damage done to the extent of several hundred dollars.

Wingham, Ont.—E. Merkley visited Toronto last week and purchased a quantity of heavy machinery to be used in a machine shop which he intends operating in the near future. The machinery purchased includes a heavy 20-foot lathe, planer, shaper and power drill. He is also arranging to install an electric motor.

Sydney Smith, head draughtsman of the Jenckes Machine Company, Sherbrooke, Que., sailed for England, Saturday, Feb. 7. He was summoned by the illness of his wife, and expects to be absent six weeks or more.

J. H. Fairbank, Petrolia, Ont., died on Wednesday, Feb. 10, aged 83. He was the sole owner of the Stevenson Boiler & Engine Works, the principal stockholder of the Petrolea Wagon Co., Ltd., and the largest individual oil producer in Canada.

W. F. Bullen and H. F. Bullen, who recently sold their shipbuilding plant to Yarrok & Co., were banqueted in Victoria last week, by prominent Victorians who desired to recognize their services in furthering the interest of the ports of Victoria and Esquimalt. Premier McBride and others spoke.

D. G. Loomis, the head and founder of the well known firm of D. G. Loomis & Sons, contractors and manufacturers, Sherbrooke, Que., has retired from the active business of the firm, which will be conducted by W. E. Loomis, and F. H. Loomis, of Sherbrooke, and Montreal, respectively.

F. N. Speller, B.A.Sc., a graduate in engineering of the University of Toronto, now a metallurgical engineer for the National Tube Co., Pittsburgh, Pa., gave a lecture on the manufacture of steel pipes and tubes before the University of Toronto Engineering Society and members of the Central Railway Club, Toronto, last Thursday.

R. J. Mackenzie, son of Sir William Mackenzie, who returned to Winnipeg last week after an absence of two years in California, will, it is stated, become active head of the Canadian Northern lines west of Lake Superior to the Pacific coast, taking the position of second vice-president.

L. L. Henderson, of the Montreal Transportation Co., Toronto, has been elected president of the Dominion Marine Association. The other officers are: First vice-president, A. E. Matthews, Toronto; second vice-president, H. W. Richardson, Kingston; Executive, George E. Fair, Collingwood; H. H. Gildersleeve, Sarnia; S. V. McLeod, Sault Ste. Marie; D. Murphy, Ottawa; J. N. Norcross, Toronto; F. S. Wiley, Port Arthur; A. A. Wright, Toronto; C. B. Harris, Toronto; H. W. Cowan, Toronto. Counsel, Francis King, Kingston.

INDUSTRIAL NOTABILITIES--No. 22

WILLIAM FORREST ANGUS, Vice-President and Managing Director of Canadian Steel Foundries, Ltd., is the son of Richard B. Angus, one of Montreal's best known citizens, and of Mary (Daniels) Angus. He was born October 28, 1871, at Montreal, with which city he has been connected all his life. On his father's side the family is of Scottish descent, and on the mother's, English.

Mr. Angus was educated in the private schools of his native city and later at McGill University, whence he graduated with the degree of B.Sc. In 1896 he went to the Dominion Bridge Company as engineer and draftsman for one year, afterwards joining the Laurie Engine Company for a short time. It was in the year 1897 that he became interested in the Canada Switch & Spring Co., and this date marks the commencement of his long and intimate connection with the steel casting industry in Canada. The Canada Switch & Spring Co. was subsequently formed into the Montreal Steel Works, and, with this latter concern, Mr. Angus occupied various positions of importance. When he first joined the old company all their steel castings were made by the crucible process, in what would now be considered very small quantities. Later, a Tropenas Bessemer Converter was installed, which marked a decided step in advance of previous methods. The demand for steel

WILLIAM FORREST ANGUS.

castings grew rapidly with the development of the country, and in the year 1900 an open-hearth furnace of 15 tons capacity was put in. It will thus be seen that M.. Angus has witnessed the growth of the Canadian steel casting industry from its earliest infancy, and is thoroughly familiar with every process.

On January 1st, 1911, the Montreal Steel Works was absorbed by the then newly-formed Canadian Steel Foundries, Limited, and Mr. Angus became Vice-President and Managing Director, which position he still holds. This company has three steel foundries, two in Montreal, and one in Welland, Ont., the combined output amounting to about 5,000 tons of castings per month.

Mr. Angus is much interested in the "Safety First" movement, and has been instrumental in introducing it into all three plants of the company. An educational campaign is being conducted by means of literature distributed to the employees, and a local committee in each plant meets regularly and reports on defective machinery or any other dangerous condition that may come to their notice. In addition, there is a general committee, composed of the plant managers, and this meets every two or three weeks to discuss safety appliances and make recommendations regarding the minimizing of the risks under which the men work.

Mr. Angus is a member of the Mount Royal, the St. James, the Forest and Stream, the Montreal Hunt, the Royal St. Lawrence Yacht, and a number of other clubs. His principal hobbies are automobiling and golf. He was married November 9th, 1904, to Miss Stearns, daughter of Sargent Stearns, of Montreal.

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Vol. XI. FEBRUARY 19, 1914 No. 8

PRINCIPAL CONTENTS.

TENSION ON CYLINDER COVER STUDS.

THE article which appeared on pages 129 and 130 of our Feb. 5 issue, entitled **Tension on Cylinder Cover Studs**, appears to have touched a responsive chord in the heart and head of quite a large circle of the readers of **Canadian Machinery**. We say heart as well as head because of the large number of expressed opinions received for publication, it being a well-known fact that timidity or want of heart courage has been and is robbing the pages of technical journals by retaining in more or less obscurity a myriad forms of high degree inventive genius with its resultant accomplishment. We refrain from making comment meantime on the particular question under discussion, it being sufficient as well as gratifying to know that given the opportunity to cultivate and develop their beings along the line of higher grade intelligence, most men will quit the groove of the automaton.

There is an impelling attractiveness and fascination in analyzing and figuring out problems involving more or less arithmetical calculation, and even although in some cases there may be an unconscious disposition to read into them more than is really involved, the ultimate results are all on the credit side. The features, however, that make study of this nature more valuable are the knowledge that a collective intelligence is being concentrated on the work of each individual, and that a corresponding benefit thereby accrues. There is absolutely no necessity for an operator harboring uncertainty in his mind, at this time of the day, as to the why, wherefore and proof of design and detail of mechanical engineering construction, and if a little more heart—pluck if you like—were brought to support the head, by readers bringing their difficulties and problems out into the open so that others could join in and help the originator and themselves, the standard of operative ability would be materially raised, and greater achievement of the craft would be made easily possible.

Another set of readers' opinions on the problem will appear in our next issue, lack of space limiting the publication of all of those received in the present instance.

THE NATIONAL TRANSCONTINENTAL RAILWAY INVESTIGATION REPORT.

A FEW weeks ago we discussed **The Attribute of Honesty** in these columns, but confined our remarks more particularly to the sphere of industrial enterprise as exemplified in the policy and management of large manufacturing and transportation corporations. Deviation from the straight and narrow is no monopoly of those directly responsible for our commerce and industry, although unfortunately an indirect influence is exerted by them otherwise. Legislation, having for its object the opening up of new territory to agricultural and industrial pursuits by the establishment of railroads and their myriad accessories, it would seem, easily takes precedence both in the matter of opportunity and scope afforded for playing fast and loose with every moral standard.

The report of the investigation into the building of the National Transcontinental Railroad of Canada, so far as made public, is anything but wholesome reading, and while it is plainly more or less partisan in its essence, a feature that is highly regrettable, there is nothing but national humiliation in its every feature. With all our boasted democracy, we as citizens of this Dominion, are the laughing-stock of the world. The vote that puts either political party into power is neither that of a man nor of democracy, and the sins of one political party are not one whit more heinous than the muck-raking of the other. It may be said that did the former not exist, the latter would be unnecessary. This is true, but, and to get at the remedy, did we ourselves play the man instead of play for the dollar, then neither the one party nor the other would be so constituted that anything but honesty, plain, individual and collective honesty, exemplified by word and deed would be the outcome.

The N.T.R. investigation and its apparent outcome are regrettable features in our national life, and the fullest and most searching inquiry is now in order relative to the Commission finding. Happenings such as these strike at the very root of our industrial development and prosperity, and go to show that personal and selfish interests take precedence over patriotism.

When anyone becomes satisfied with himself, there is but little in him that satisfies other people.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3....	19 50	20 00
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3.......	19 50	20 00
Clarence, No. 3........	19 50	20 00
Jarrow	.....	23 50
Glengarnock	......	26 00
Summerlee, No. 3......	22 00	.....
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1........	19 40	18 35
Victoria, No. 2X	19 15	18 10
Victoria No. 2 Plain ..	18 90	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh.........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal......	2.10
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh.....	1.20
Steel hoops, Pittsburgh..........	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, 5/8 diam., 100 lbs.		2 85

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ in., 100 lbs...	$2 30	$2 20
Heads, per 100 lbs.......	2 55	2 55
Tank plates, 3-16 in......	2 60	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	9 00	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate Washers	45
Machine bolts, 3/8 and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb off
Nuts, Hexagon, all sizes..	4½ per lb off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, bronze	70, 10, 7½, 10 p.c. off

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in...	75%
Finished Nuts over 1 in....	72%
Semi-Fin. Nuts up to 1 in..	72%
Semi-Fin. Nuts over 1 in...	72%
Studs.....................	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 00	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings..	9 00	9 00
No. 1 wrought iron.....	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	13 00	12 00
New brass clippings....	8 50	8 75
No. 1 brass turnings....	7 25	7 50
Heavy lead	3 75	4 00
Tea lead	3 00	3 00
Scrap zinc	3 00	3 50

LIST PRICES OF W. I. PIPE.

Standard.		Extra Strong,		D. Ex. Strong,	
Nom. Diam.	Price. per ft.	Sizes Ins.	Price per ft.	Size Ins.	Price per ft.
1/8in	$ .05½	1/8in	$ .12	½	$. 32
¼in	.06	¼in	.07½	¾	.35
3/8in	.06	3/8in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	.....	...	.....
10 in	3.50	....	.....	...	.....
10 in	4.12	....	.....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, 3/8 in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in. ..	....	....	67½	56½
X Strong P. E.				
¼, 3/8 in	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto
Lake copper, carload....	$16 00	$15 75
Electrolytic copper	15 75	15 25
Casting coper	15 25	15 00
Spelter	5 25	5 25
Tin	43 00	43 00
Lead	5 25	5 40
Antimony	8 50	8 50
Aluminum	21 00	19 00

SHEETS.

	Montreal.	Toronto
Sheets, black, No. 28	$2.75	$2.90
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	4.00	4.15
Apollo brand, 10¾ oz. (American)	4.30	4.10
Queen's Head, 28 B.W.G.	4.40	4.20
Fleur-de-Lis, B.W.G.	4.20	4.20
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.40	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal.	0.23
Pure turpentine	0.66
Linseed oil, raw	0.62
Linseed oil, boiled	0.65
Plaster of Paris, per bbl	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Feb. 16, 1914.—The weather during the past week has been unusually cold and has had its effect in diminishing business in certain trades. The building industry was, of course, particularly hard hit. This trade has been slack for a long time, owing to the scarcity of money. A great improvement, however, is prophesied for next summer when a start will probably be made with the big city terminals of the Canadian Northern Railway. There is also likely to be great activity in residential construction, the present demand for houses exceeding the supply in a manner that far outdistances former years. On the other hand few large office buildings are at present projected for this year. So many buildings of this type have been erected in Montreal during the past two or three years that the demand for office accommodation seems to be fairly well satisfied for the present.

The machinery trade is still waiting for the contracts to be let for the equipment tendered on for the Prince Rupert dry dock of the Grand Trunk Pacific. This matter is being handled by W. T. Donnelly, consulting engineer, New York, and enquiries made this morning at the G. T. R. purchasing agent's office in Montreal, elicited the information that nothing was known locally as to when the orders would be placed.

Machinery houses have closed several nice orders during the past week or two, but the common complaint is that, instead of a steady volume of trade, orders come in spasms. The railways are doing very little buying just now, though it is believed that the Grand Trunk may issue specifications for machine tools shortly. Mussens, Ltd., report having sold to the Department of Agriculture and Highways of the Quebec Government two 8-ton and two 5-ton road rollers, two Farquhar traction engines, and two Austin reversible graders. They have also closed an order for three Bucyrus steam shovels for the Grand Trunk Railway.

In anticipation of an early spring, good orders for boom chains are being placed by the lumber interests. Tool steel salesmen report that business is improving slightly, though still much below normal.

The metal market is unchanged from last week. A fair quantity of foundry pig iron has been sold, but otherwise things have been quiet.

Toronto, Ont., Feb. 17, 1914.—While the demand for immediate shipment of steel shows no marked increase, there is a tendency on the part of iron and steel manufacturers to quote higher prices for future deliveries. Much depends on the nature of the order. Reasonable rates may be secured in cases where a consumer requires a large quantity of one section. Steel makers are sure that business in the second quarter will be good. They are also determined that prices in the summer will be higher than those obtaining now. For that reason local manufacturers and structural steel men are covering themselves.

The demand for boiler tubes and plates is good, and some first-class orders are being placed. Tank work has also shown signs of improvement. General manufacturers and foundrymen are not showing so much anxiety to purchase. Most of the present business is going to mill, and warehouse is quiet.

Prices the Same.

Prices on most steel products remain unchanged. While little cutting is being experienced in bars and shapes, there is a tendency for smaller manufacturers of wire and nails to offer better prices, thus taking good business out of the hands of larger concerns. Several big contracts have been lost this week by manufacturers who have a fixed price, and will not go lower to meet competition.

Since the report last week that a large steel concern in the United States was contemplating the establishment of a furnace and rolling mill on Ashbridge's Bay, Toronto, it has come to light that several American steel makers are planning an invasion of this territory. In one case it is a New England firm who have not met with much success in the American field, and are thinking of removing their whole plant into Canada.

Machine Tools.

While the steel business is picking up, the machine tool and supply business remains dead, and some of the largest houses freely admit it. The large railways who some weeks ago declared their intention of buying heavily in machine tools, are now disposed to postpone buying until a later date.

The National Transcontinental Railway who issued specifications for machine tools required at Grant and other points, costing in the neighborhood of $40,000, have postponed buying indefinitely for some reason unknown to local brokers. In this case too, recommendations had been made. This action is thought to be the result of the startling report made by the commission appointed to investigate the cost of the line.

Orders Being Placed.

The order for machine tools required by the Buffalo Forge Co. will be placed this week either in Buffalo or Berlin. These will be required for the new plant this firm has recently erected there for the manufacture of blowers and exhausters. A. G. Spalding Bros. manufacturers of sporting goods, purchased a four-spindle drill, a riveting machine, and several other tools this week, for use in their new plant at Brantford. They intend building a larger plant shortly.

As will be seen by reference to another section of Canadian Machinery, The National Cash Register Co. are purchasing a large quantity of machine tools, foundry supplies, etc., for their new plant on Christie street, Toronto. The Canadian Kodak Co. who are pre-

paring to erect a large plant in Toronto, will not be in the market for tools inside of a year, at least. The only district that seems to be buying at all freely just now, is Cobalt. They appear to have the money, and have enjoyed a good winter. There is a brisk demand for pumping machinery and general equipment.

Metals.

During the past few weeks there have been marked signs of strengthening in the metal market, but a weakness set in early this week, the price of copper dropping considerably. The business is reported by large firms to be at a standstill. A little business is being done in old material.

St. John, N.B., Feb. 16, 1914.—As the result of a start having been made in a new line of manufacturing in St. John last week, there are excellent prospects of a substantial permanent industry giving employment to a large number of men, being established. The arrangements are in the hands of Hon. S. O. Bigney, of Attleboro, Mass., and M. E. Innes, of this city, and it is necessary for them to start immediately to protect the Canadian patent on the article to be manufactured—a new line of suspenders, in which the necessary elasticity is supplied without the use of rubber. It is done by using three concealed ball-bearing springs, which will outwear the webbing without losing anything of their elasticity. The articles have been on the American market for some time, being manufactured in Attleboro, Mass., where a big plant is established. Hon. Mr. Bigney expects to have a local factory in operation very soon, and arrangements to that end are now being made.

The Board of Trade will endeavor to secure a drydock for this port similar in size to those being built elsewhere by the Government. A contract has been let at Quebec for a drydock there of 1,150 feet, and the St. John Board of Trade have appointed a committee to make representation to the Government to have the local one made at least that length.

J. Norton Griffiths, head of the Norton Griffiths Co., Ltd., was in the city last week and said that the working plant of his concern at Courtenay Bay, East St. John, would be greatly increased as soon as they could secure more dredges. "Four more dredges are to be brought here," he said, "and it is possible that we may build one in St. John. If we build, the machinery will be secured in Canada and the construction of the dredge will be commenced at once at Courtenay Bay. This suction dredge will have a twenty-inch sucking apparatus and will have cutters arranged so as to reach to a depth of more than fifty-five feet below the bottom of the dredge. I expect that these dredges will be here in April and the work at Courtenay Bay will be rushed to a greater extent than ever before."

Manning W. Doherty, of the Maritime Dredging and Construction Co., on his return a few days ago from Ottawa said that the timber for the new wharves at West St. John will be delivered within six weeks and work will be started immediately, and construction rushed. Two hundred men will be employed in the work, and two new berths will be completed by December 1. The Doherty Company have taken over the contract formerly held by Connelly & Charlton.

The Hewson Woolen Mills at Amherst, N.S., have resumed operations and will probably be kept running until after the committee appointed to investigate the financial history of the Hewson Pure Wood Textile Co. since the organization of that concern two years ago, have submitted their report.

Trade Gossip

Thomas Brothers, St. Thomas, who were reported in the newspapers last week to have made an assignment, will continue business, the report being incorrect.

The Sasgen Derrick Co., an Illinois corporation, has been authorized to manufacture derricks, hoists, and contractors' equipments, in Ontario. Mathias T. Sasgen, Toronto, attorney.

W. A. Casey, for the past year municipal engineer of Esquimalt, tendered his resignation to the works committee of the municipal service last week. C. H. Topp was communicated with and appointed to succeed him at once.

N. S. Steel Statement.—The annual statement of Nova Scotia Steel & Coal Co., presented to shareholders last Monday, showed net profits for 1913 of $1,-255,953, compared with $1,000,609 for 1912. The excess current assets over liabilities is shown as $1,593,744.

A Profit-sharing Plan.—In response to the proffer of shares on the instalment plan made to all employees of the International Nickel Co., who conduct themselves to the satisfaction of the management, some 1,440, or 40 per cent. of those on the pay rolls of the parent and subsidiary companies have hastened to enter into the agreement.

Canada Car Employees.— From both the Dominion and Turcot plants of the Canada Car Works seven hundred employees gathered at the Montreal West End Y.M.C.A. last Thursday, and enjoyed a programme of sports and games which included bowling, swimming, billiard and gymnasium work. A tug-of-war resulted in a victory for the Dominion shops. Mr. Butler, general manager of the company, was master of ceremonies.

Lost an Industry. — The industrial commissioner of Welland, Ont., speaking on the moton to secure a block of land for factory sites, stated that a Chicago firm wishing to erect a four-storey building and employ several hundred hands had been lost last week, because a site could not be offered at a suitable price. Guelph got the concern by giving a free site. Outside of the town every bit of railway frontage had been cut up into subdivisions, so that it was now necessary to jump a mile to get a piece big enough for an industry.

The Redcliff Rolling Mills, Ltd., held their annual meeting in Medicine Hat, Alta., on Tuesday, Feb. 10, and officers and directors were elected as follows: President, W. B. Marshall; vice-president, Dr. J. C. Hargrave; secretary-treasurer, H. A. Hunter; managing director, W. F. Goodison; directors, H. O. Wheeler, Wm. Mitchell and W. H. Hargrave. The financial reports which were accepted by the meeting showed the company to be in a healthy financial condition, and the business outlook was reported to be excellent.

The Doon Twine and Cordage Co., of Doon, Ont., have made a new departure during the past week. A large room, 40 x 60 feet, in their plant, has been set apart as a reading room and a place for congregating and indulging in games. Billiard tables have been provided, which fill a long-felt want. A committee of twelve has been appointed under whose control and management the undertaking is placed. Two will be present each evening and see that the rules are strictly enforced. Others than those in the employ of the company are permitted to enjoy the privileges by paying a small fee.

The Smart-Turner Machine Co., Hamilton, Ont., have recently secured the following orders:—The Canadian Salt Co., Windsor, Ont., simplex pump; the Imperial Vinegar & Pickling Co., Hamilton, duplex pump; the Dominion Dredging Co., Port Weller, Ont., motor driven centrifugal pump; the Imperial Tobacco Co., Ltd., Montreal, Que., centrifugal pump; G. H. Dooer & Co., Berlin, Ont., duplex boiler feed pump; the Rapid Power Co., Morrisburg, Ont., centrifugal pump; the Canadian Flax Mills, St. Catharines, Ont., centrifugal pump; J. D Nairn, Bartonville, Ont., duplex power pump; S. Allen, Ltd., Norwich, Ont., duplex power pump; the London Pressed Brick & Tile Co., London, Ont., duplex pump.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Hamilton, Ont.—The assignee's sale of the Schacht Motor Car Co.'s assets took place last Tuesday.

Fort William, Ont.—A fire broke out in the plant of the Canada Iron Corporation last Friday, destroying a partition and part of the roof.

Chatham, Ont.—The Chatham Bridge Co. have been in the market for an engine and sand pump outfit. They are not ready yet to purchase machine tools

Fergus, Ont.—Beatty Bros., Limited, are making extensions by installing a $5,000 plant for galvanizing their stable equipment.

Ottawa, Ont.—J. J. Carrick, M.P., will propose a resolution in the House that the development of Canadian iron ore deposits should be more fully encouraged by the Government.

Toronto, Ont.—A permit was issued Monday to the Canadian Seamless Wire Co. for the erection of a two-storey brick factory at 198 Clinton street, to cost $18,000.

Toronto, Ont.—The Ford Motor Co. will shortly erect a new five-storey building at the corner of Dupont and Christie streets, and from 500 to 600 workmen will be employed. The new building will be finished early next fall and work will be started on it almost immediately.

Hespeler, Ont.—Otto Gramph, of the Stamped and Enameled Ware, Ltd., has prepared samples for the Hardware Convention, at Ottawa, and during the next twelve months will make extensions to his plant.

Fredericton, N.B.—Hon. H. F. McLeod, M.P., has announced on the authority of Mr. Gutelius, general manager of the Intercolonial Railway, that the St. John Valley Railway shops will be erected here.

Montreal, Que.—The Sullivan Machinery Co., makers of air compressors and mining tools, Claremont, N.H. and Chicago, will erect a plant in Montreal for handling the Canadian end of their trade.

Sherbrooke, Que.—Mackinnon, Holmes & Co., manufacturers of steel plate and structural work, advise that they have not yet completed plans for proposed extensions to plant, but expect same to be ready shortly.

Bedford, Que.—The Bedford Manufacturing Co., makers of axes, scythes, etc., advise that they have not yet decided on the number of buildings they will erect to replace the plant burned. They hope to decide this week.

Hamilton, Ont.—The old site of the Hoepffner refinery, located in East Hamilton, will be purchased by a company to be incorporated, which will refine ores by a new process. D. M. Cameron, Aberdeen ave., is interested.

MACHINE TOOL REQUIREMENTS.

The Grand Trunk Railway System has issued a list of machine tool requirements for delivery to the Port Huron, Mich., Shops, as follows:—

1—Bridgeport double head axle lathe.

2—42-inch car wheel boring machines.

1—American Tool Works Co. 6-foot plain radial drill, high speed.

1—54-inch Colburn new model boring mill.

1—Westinghouse, triple valve testing rack.

1—acetylene autogenous welding outfit.

1—steam-driven air compressor, 1,000 cubic feet free air per minute, Blaisdell or equal.

1—20-inch back geared wheel and lever feed drill press, power feed, automatic stop.

1—14-inch ball bearing sensitive drill press, Henry & Wright or equal.

1—42-inch steel tire coach wheel lathe.

1—50-horsepower, reversible, variable speed, direct-current motor.

2—5-horsepower motors, as above.

1-double machine punch and shear combined, 18-inch throat.

2—Davis expansion boring tools, 8½-inch.

St. Catharines, Ont.—It has been agreed to fill the large number of orders received by the Shurley-Dietrich Co., Galt, for saws from the plant of the R. H. Smith Co., St. Catharines. In order that the greatly increased output may be produced, the smith factory will go on night and day shifts and a large number of the Galt employees will be given jobs at St. Catharines.

Sault Ste. Marie, Ont.—William Edward Seelye is interested in a company known as the Seelye Combination Axe & Tool Co., who will equip a plant here for the manufacture of axes, tools, and tool holders. The company has a capital of $40,000.

Medicine Hat, Alta.—Construction work has begun on the main building of the Medicine Hat Radiator Co.'s new plant. The structure will measure 80 x 290 ft. with 14 ft. ceiling and costing $100,000. L. Carey Wright, the manager, has charge of the work.

Windsor, Ont.—The Standard Mfg. Co., is opening up a branch factory in Windsor to manufacture double-acting checking floor hinges and oil checks for the Canadian trade. The head office is in Shelby, Ohio. The Windsor plant will be located at No. 3 Ferry street

Maple Creek, Sask.—The Canadian Hunt Mfg. Co., advise us that the first building of their new plant will cost $40,000, and will be commenced this spring. They will make threshing machines, fanning mills and farm implements. The company is capitalized at $700,000.

Maisonneuve, Que.—The Structural Steel Co., of Tetreaultville, Que., are erecting a large plating shop for the Canadian Vickers Dry Dock Company. The new structure is one of the largest of its kind in Canada. Most of the machinery is being imported from England and Scotland.

Kingsville, Ont.—The R. F. Green Co. have been loaned $6,000 by the town, and will go ahead in the Spring with the erection of a plant for the manufacture of gas ranges and ovens. Cement will probably be used. Much of the equipment in the present plant will be transferred.

Windsor, Ont.—The plans as outlined for the plant of the United States Steel Corporation at Ojibway call for two or three blast furnaces, an undetermined number of open hearth furnaces, and rail, structural, bar, plate and wire mills. It is expected that ground will be broken in the spring and that the wire plant will be built first.

Brantford, Ont.—James E. Walsh, general manager of the Power Plant Supply Co., of Detroit, and representing the Canadian Crate and Supply Co., has written to the city council expressing a desire to open a plant in Canada, and requesting information relative to the industrial standing of the city.

Fort William, Ont.—The Dowswell Sheet Metal Works of West Fort William have completed arrangements to extend their plant back forty feet, the present site occupying the corner of Ford and Brock streets. Their purpose will be to manufacture a sanitary closet, a modern device to be placed in homes that have not plumbing or sewer connections within.

London, Ont.—W. Barnett, Montreal, electrical engineer of the Grand Trunk, was here on Wednesday, February 11, to discuss with General Manager Glaubitz a contract to supply hydro-electric power for the G. T. R. carshops. It is expected that the company will take from 500 to 1,000 h.p. eventually. The whole system will be changed in the east end shops if an agreement can be arrived at.

Galt, Ont.—The Shurly & Dietrich Co., whose saw and bedstead plant was destroyed by fire last week, carried insurance of $80,000, which will cover not more than one-third their loss, if that much. The company were proceeding with a new plan for rewriting their insurance, and had only got fairly under way when calamity overtook them. Mr. Dietrich, it is understood, intends to rebuild.

Sault Ste. Marie, Ont. — The general manager of the Algoma Steel Corporation, Ltd., advises that they are adding two open hearth furnaces to their plant, bringing the total number of furnaces in the open hearth dept. to seven. The Hamilton Bridge Co. secured the contract for extensions to building. The major part of the work connected with the furnaces will be done in the company's own shops by their own men.

Goderich, Ont. — The American Road Machinery Co., of Canada, Ltd., manufacturers of crushing, road-building and contractors' machinery, will start the erection of an up-to-date new plant shortly, 400 ft. long and 110 ft. wide, with 70 ft. runway for electric cranes. The latest ideas in design will be embodied. It will be of steel skeleton construction, concrete curtain walls and modern fireproofed roof. Electric power wil be used throughout and a vacuum heating system will probably be installed. An up-to-date line of machinery is to be installed in the plant.

Niagara, Falls, Ont.—The Canadian Automatic Parcel Checking Co., recently incorporated, with a capital of $200,000, are making arrangements with the Davis Acetylene Co. to manufacture their parcel-checking lockers in this city. The president of the company is Mr. Ballou, who is general manager of the Menasha Paper Co. and a director in the Minneapolis, St. Paul and Sault Ste. Marie Railway. The cabinets, which are to be manufactured in this city, have from eight to 18 lockers, each locker being large enough to hold suitcase, grip, overcoat, etc.

Electrical

Buckingham, Que. — The municipal council are contemplating the installation of an electric lighting system.

Burford, Ont.—The ratepayers of the village wil vote on March 9 on a by-law to authorize the council to contract for hydro power for the municipality.

Walkerville, Ont.—The Heinze Electric Co., Lowell, Mass., it is reported, will build a branch plant here for the manufacture of electric motors, etc.

Wilkie, Sask.—It will be some months before the town of Wilkie is in a position to submit a by-law and make the contemplated extensions to their power plant.

Lacombe, Alta.—A contract has been awarded to the Canadian General Electric Company for a 100 k.w., 2300 volt, 3-phase, 60-cycle, 277 r.p.m. engine driven generator.

Medicine Hat, Alta.—The city council included in their estimates the sums of $10,000 for electrical distributing system, and $20,000 for street lighting purposes.

Coteau Landing, Que.—La Compagnie Electrique de Saint Polycarpe, Limited, has been incorporated with a capital of $20,000, with head office here, to carry on business as electrical engineers.

Fort William, Ont.—The Canadian Car & Foundry Co. are using electric power at their new plant here. The amount at present developed is 300 k.w., but 2,000 k.w., will ultimately be developed.

Hamilton, Ont.—The Dominion Power and Transmission Co., have bought machinery from the Canadian Westinghouse Co., to the value of over $270,000, and another contract has been let for over $360,000 worth. The frame of the new power building has been constructed, and the bases for the machinery built.

Saskatoon, Sask. — The Northland Milling Co. will erect a transmission line from Saskatoon to Factoria, costing between $15,000 and $16,000, of which the city would only be asked to pay $6,000. The proposed line would carry 2,200 volts, and would deliver 350 k.w.

Sydney, N.S. The fire commission has decided to recommend the installation of storage batteries at the central fire station for the alarm system in place of the present gravity system. The proposal to place police call boxes around the city was referred to the police commission.

Fort William, Ont. The Mount McKay and Kakabeka Falls Railway Co. is planning to electrify the road, and make further extensions into the country. If it be determined to electrify the railway, a regular service will be given connecting with the city at some point, and power will, for the time, be obtained from the Kaministiquia Power Co.

Kingston, Ont. — The Napanee Improvement Co. have made a proposition to the Kingston council regarding the supply of cheap electric power from a suggested development at a point known as Third Depot Lake where there is said to be from 1,000 to 2,000 h.p. available. The communication was made to the council through A. W. Benjamin, of of Yarker.

Woodstock, N.B.—The county councillors have given consent to the Maine & New Brunswick Electric Power Co. to erect their 30,000 volt transmission line through the township to the town of Woodstock. This company develop power at Aroostook Falls, N.B., and will supply power to the municipalities along their new transmission line, and in Woodstock.

Winnipeg, Man.—Sir. Wm. Mackenzie made two important announcements here last week in regard to future developments by his companies. The first was that the C.N.R. expected to proceed at once with the construction of the new line to Victoria Beach and Grand Marais, and the second was that the Winnipeg Electric is preparing to go ahead with the work of developing the power site at Big Bonnet Falls.

Toronto, Ont.—Expenditures approximating between two and three million dollars are involved in the construction programme of the Hydro Electric Power Commission for this year. In addition to the duplication of the trunk lines of the Niagara system from Dundas to Niagara Falls, which will cost about $700,000, a 46,000 volt line from the Falls to Welland is to be immediately built of extra heavy construction at a cost of $400,000.

The Motor Truck Feature at the Toronto Automobile Show

Staff Article

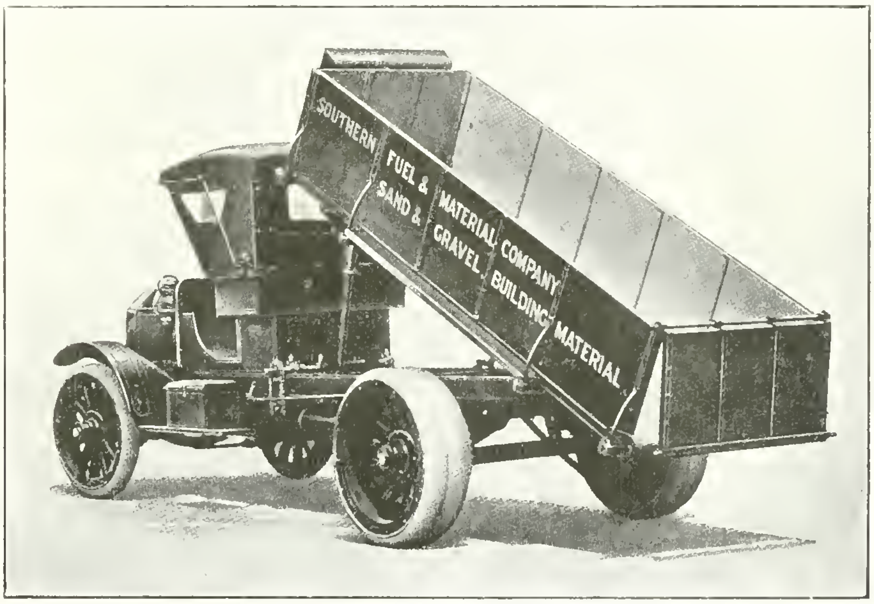
There was no mistaking the increasing popularity of both the automobile for pleasure and the motor truck for business by even the casual visitor at the recent motor vehicle show held in a section of the C.N.E. Buildings, Toronto, and the unqualified success of this annual enterprise will not fail to become easily evident on our already busy and somewhat congested city streets. Both for pleasure and commercial cars many new enthusiasts have been added to the list of owners.

THE annual Toronto Automobile Show was held at the Exhibition Grounds, February 14 to 21 inclusive. One of the distinctive features was the increased number of motor trucks exhibited; these included heavy and light models and delivery trucks. This feature, no doubt, reflects the growing interest being displayed by manufacturers, express companies and others in the problem of transportation by means of motor trucks. The facility with which modern trucks can be operated, the increased loads that it is possible to carry, and also the improvement in design and construction which is apparent each year, are all responsible for the increasing popularity of this type of vehicle.

Pleasure Car Feature.

Pleasure cars, of course, comprised the largest number of exhibits, most of the leading makers being represented. It cannot be said that there were many startling improvements in design, pleasure cars having now almost reached that state of perfection where radical changes in design seem to be almost impossible. Self-starting apparatus seems to offer the greatest field for improvement.

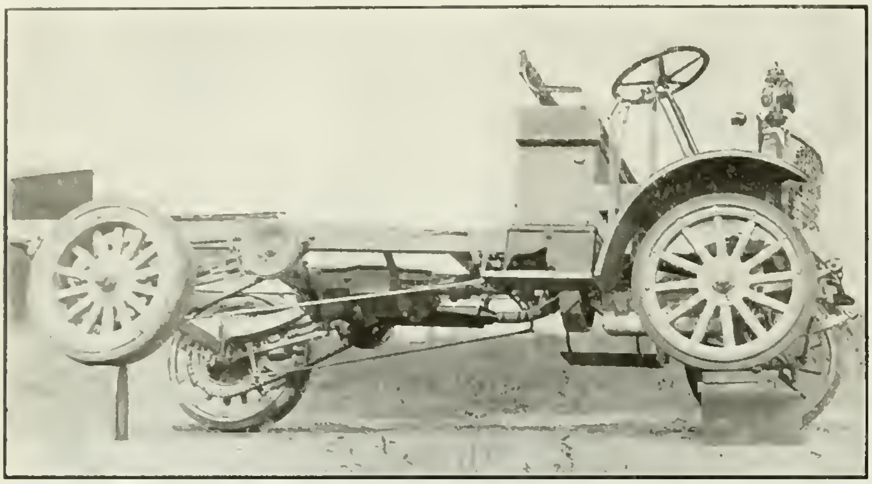
Among the pleasure car exhibits were to be seen that of the Russell Car Co., Toronto, whose exhibit included a chassis in operation, a number of standard models and a motor ambulance recently donated to the Toronto General Hospital by Mr. T. C. Eaton. The "Cadillac" cars were exhibited by Hyslop Bros., Toronto, while the Automobile Supply Co., Toronto, were showing the Pierce Arrow, Paige-Detroit, Chalmers and Hupmobile, the latter car being equipped with a Westinghouse self-starter. The Ford Motor Co., Walkerville, had one of each type which they make, and were also exhibiting a production chart showing the output each hour of the current day, for both the Canadian and American factories. The Ontario Motor Car Co., Toronto, were showing a number of Packard pleasure cars in addition to the truck. The Republic Motor Co., Toronto, were exhibiting Oakland and Republic cars, while the York Motors, Ltd., Toronto, had several Studebaker and Cole cars. The White Co., Toronto, exhibited a number of cars and trucks, and the Do-



5-TON "PEERLESS" MOTOR TRUCK

GENERAL VIEW—TORONTO AUTOMOBILE SHOW.

minion Automobile Co. were showing Peerless cars and a truck, also Hudson and Stephens-Duryea pleasure cars. The



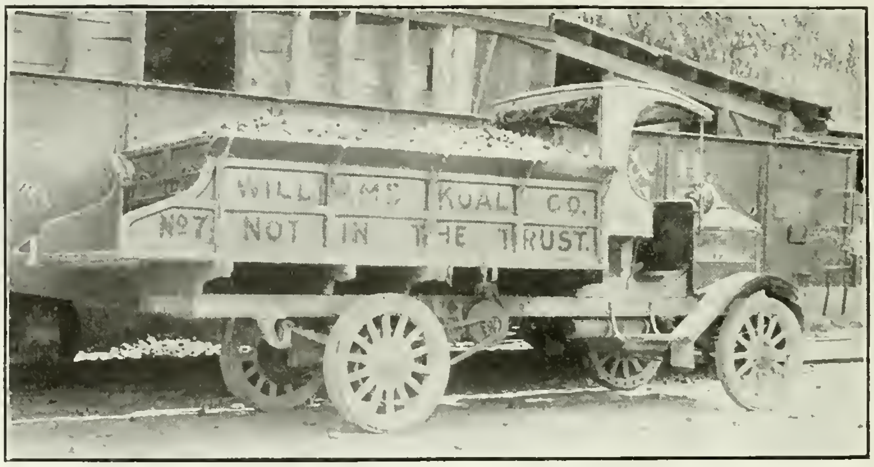
2-TON "GRAMM" MOTOR TRUCK CHASSIS.

Wolseley Tool and Motor Car Co., Toronto. were exhibiting several fine models, also a chassis. The Reo Motor Car Co., St. Catharines, Ont., exhibited both trucks and pleasure cars. Electric pleasure cars were exhibited by the Tate Electrics, Ltd., Walkerville; Detroit Electrics Co., Detroit, and by Death & Watson, Toronto. The "Overland" car was to be seen, as were also pleasure cars and delivery trucks exhibited by the McLaughlin-Buick, Oshawa, Ont.

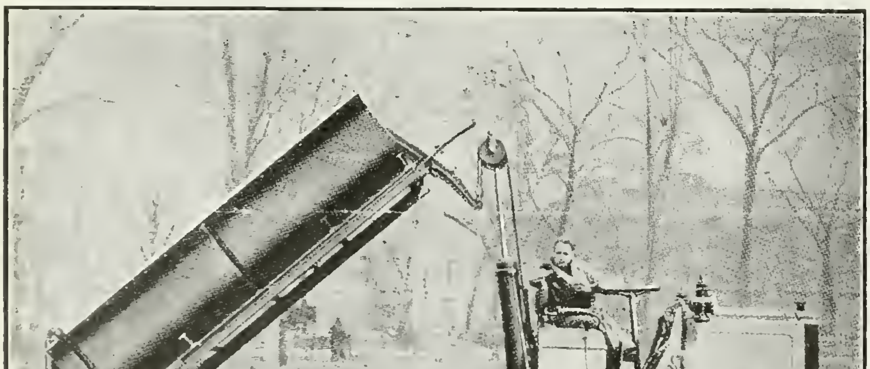
There was the usual display of tires and accessories, while oil supply systems were exhibited by the S. F. Bowser Co., Toronto.

Motor Trucks.

The motor truck exhibits included trucks of various capacities up to 5 and 7 tons, the 5-ton models being represented by the "Commer" car, Albion, Packard, Peerless and White trucks. A comparatively new feature to be seen in connection with the majority of the heavy service cars was a speed control device, generally consisting of a centrifugal governor attached to the crank shaft and operating on a valve in the fuel supply pipe to the cylinders. This apparatus shuts off the supply of oil when a certain speed has been attained, usually from 10 to 12 miles per hour. The arrangement protects the truck from traveling at excessive speeds, and from probable injury, especially when loaded. Chain drives seem to have been generally adopted for heavy trucks, and worm drive for some of the lighter models. With the exception of one electric vehicle, all the trucks were equipped with gasoline motors.



2-TON "REO" MOTOR TRUCK.



5-TON "PACKARD" MOTOR TRUCK.

Albion Trucks.

The Albion Motor Car Co. of Canada, Ltd., Montreal, exhibited a 5-ton truck having one or two interesting features. One of these is a centrifugal governor on the crank shaft, which shuts off the supply of gasoline when a speed of twelve miles per hour has been reached. The device operates independently of the drivers, and only comes into operation at the maximum speed. Another feature is the disc clutch, which consists of two asbestos rings connected to the motor shaft and a steel disc between them connected to the drive shaft. The co-efficient of friction being a fixed value, the clutch when engaged will only transmit a given power, thus protecting the gears. The carburettor is situated inside the water jacket, and is always kept at an even temperature, thereby enabling the same results being obtained at all times. Trucks up to $2\frac{1}{2}$ tons have worm drive, and those from $3\frac{1}{2}$ to 5 tons are equipped with chain drive.

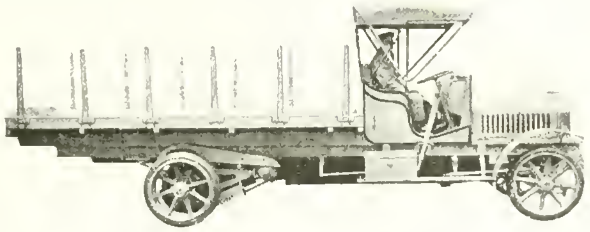
Packard Truck.

An interesting exhibit was the Packard 5-ton truck, equipped with a dump body. The dumping mechanism consists of a cylinder filled with oil, which is forced from one end by a centrifugal pump driven from the motor shaft. When lifting the front of the body the oil is forced to the bottom section of the cylinder from the top section, and when lowering the action is reversed. The truck is equipped with a 4-cylinder slow-speed motor and chain drive, and with a centrifugal governor for controlling the

speed when a maximum of ten miles has been reached. There were also on show a number of delivery trucks.

Thornycroft Truck.

Two Thornycroft trucks were exhibited by the Maritime Motor Co., St. John, N.B., who were also showing a "Maritime Singer" pleasure car chassis. The largest truck has a capacity of 3 tons and is equipped with a 4-cylinder motor with cylinders 4½x5 stroke. The wheels are of cast steel fitted with solid rubber tires and have chain drive. One special feature of this truck is the tilting front axle which is so constructed that when the truck is traveling over uneven ground, the frame is not subjected to any twisting strains. Adjustable windshields are fitted and the cab is exceptionally roomy. The 2½-ton truck chassis is equipped with worm drive, cast steel wheels and solid rubber tires. Both models are furnished with speed control governors. It will be interesting to note that the Thornycroft trucks have gained awards in a number of reliability trials under the supervision of the British war office.



2½-TON ALBION MOTOR TRUCK

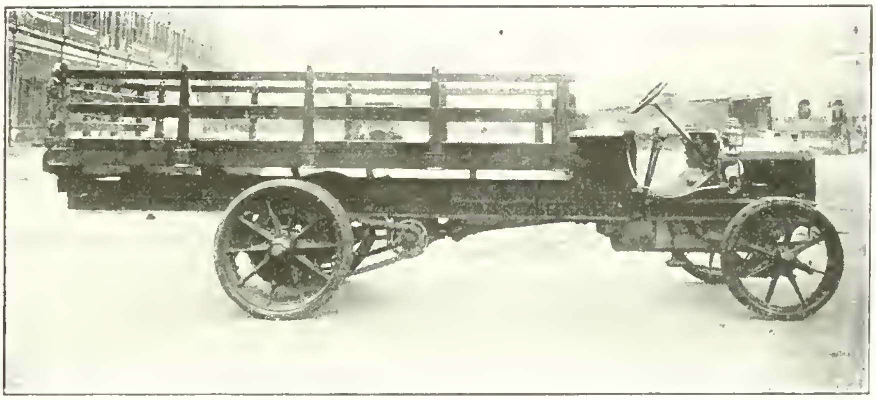
Peerless Truck.

The Peerless Motor Car Co., Cleveland, O., were exhibiting a 5-ton power dumping truck operated by a double screw power hoist. The hoist operates on the telescoping screw principle, one screw working inside the other and each in turn taking half the travel of the body. This arrangement reduces the amount of head room which would otherwise be required if only a single screw were used. The screws are operated

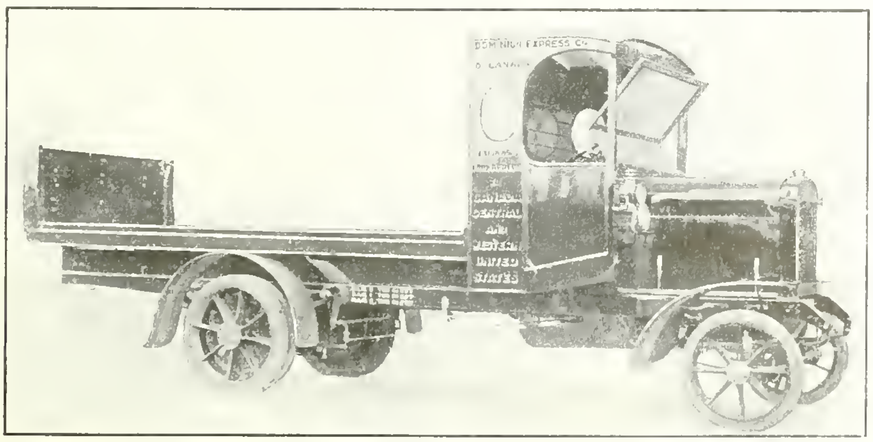
from a secondary shaft in the gear box. The truck is fitted with a 3-point suspension, 4-cylinder motor, and a speed control governor.

"Commer" Car.

Four trucks made by the Commercial Cars, Ltd., Luton, Eng., were exhibited by the Industrial Motor Trucks, Ltd., Toronto. The exhibit consisted of one 7-ton, two 5-ton and one 1½-ton trucks. The two former models are built for heavy service and are equipped with enclosed chain drive, while the lighter model has worm drive. One of the outstanding features of the heavy trucks is the speed gear mechanism. The gears in the gear box are always engaged and, therefore it is impossible to strip the teeth. The drive is effected through sliding dog-clutches which are moved by fly-to-centre levers operated by a lever in the steering pillar. On the drive shaft forward of the gear box is a clutch fitted with rubber pads for taking up the shock. This clutch comes into operation first. The two 5-ton trucks have been sold to the Motor Transport Co., Hamilton, Ont.



3-TON WHITE MOTOR TRUCK



3-TON THORNYCROFT MOTOR TRUCK

Gramm Truck.

The Gramm Motor Truck Co., Walkerville, Ont., exhibited a 2-ton chassis which was sufficient to demonstrate the principal features embodied in the design of this company's product. The transmission and bearings are all of the Timken make and all wearing surfaces are well lubricated. The gears and differential are together in one gear box, making a very compact arrangement. A centrifugal governor is fitted to the motor to control the speed when reaching the maximum, and the radiator is protected by a guard. The weight distribution is one of the principal features of this truck.

"Reo" Truck.

A 2-ton truck was exhibited by the Reo Motor Truck Co., Lansing, Mich. One of the principal features to be noticed was the construction of the radiator, which is built in units, thereby enabling any single unit to be removed, in case of leakage, without the truck being taken out of service. This truck is fitted with a speed control hydraulic governor operated by pressure of water in the cylinder water jacket system, the water being circulated by a pump on the motor shaft. The pressure of water operates on a diaphragm valve fitted in the full supply pipe.

McLaughlin-Buick Truck.

The McLaughlin-Buick Co., Oshawa, Ont., were exhibiting, in addition to the pleasure cars, two 1,500-pounds delivery trucks and a chassis of the same model. These trucks are equipped with centre shaft drive, artillery wheels and pneumatic tires.

Ward Electric.

The Ward Motor Vehicle Co., New York, had an electric delivery truck and one chassis. The former has a capacity of 2,500 pounds and is equipped with a Westinghouse motor, Ward or Edison

batteries. The chassis has a capacity of 2½ tons and is furnished with the same equipment.

Brantford Truck.

Two models of delivery trucks were exhibited by the Brantford Motor Truck Co., Ltd., Brantford, Ont. The capacities range from 1,000 to 1,500 pounds and both models are equipped with planetary type transmission, four cylinder motors, artillery wheels and rubber tires.

CHILLED IRON CAR WHEELS.

GEORGE W. LYNDON, in a paper prepared for the Association of Manufacturers of Chilled Car Wheels, estimates, says the Iron Age, that there are 20,000,000 chilled iron wheels in service. In the last three years more than 300,000 special chilled iron wheels have gone into freight service, the majority of them on cars of 50 tons or greater capacity, many of which are operating in localities where severe conditions are imposed. One test is mentioned of a large railroad which in 1907 equipped 50-ton coal cars to the number of 500 with special chilled wheels. The cars operate, as a rule, in mountainous country and are constantly in service. It is found that at the close of the sixth year more than 80 per cent. of the wheels are still in service, and it is predicted that the average life will prove to be eight to ten years.

Mr. Lyndon considers that chilled wheels have the following advantages over other types of wheels:

Greater economy in first cost and shop expense.

Less loss of metal in tread and flange per ton mile of service.

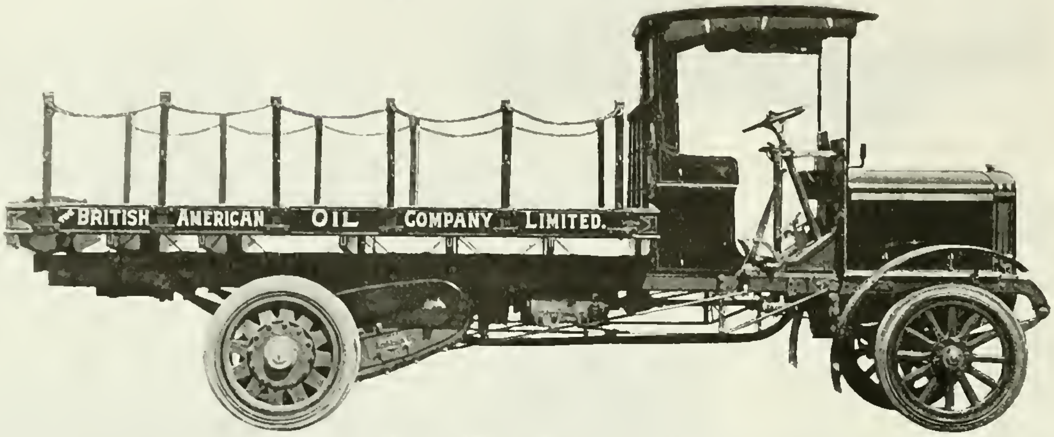
Greater ability to carry heavy loads, as the tread metal does not flow under pressure.

Twenty to 25 per cent. greater braking efficiency.

Twenty to 40 per cent. less consumption of brake shoes.

Less abrasion of steel rails.

Less power consumption.



5-TON "COMMER" MOTOR TRUCK.

ALLOY STEEL IN LOCOMOTIVES.

THE use of alloy steel, properly heat treated, for locomotive parts, has been attended with much success. In addition to those parts where the steel is used for its effect in giving greater reliability or improved wearing quality, such as frames, springs, axles, and tires, it is also used for other parts where, indirectly, it permits of a large increase in the capacity of passenger locomotives. This result, states the Railway Gazette, arises from the fact that the permissible weight that can be placed upon the coupled wheels depends very largely on the weight of the excess counterbalance that is included to balance the reciprocating parts, and therefore by lightening these parts and reducing the excess it is possible to use an increased static weight on the driving wheels. This, in turn, means that the boiler can be very materially enlarged, and thus the capacity of the locomotive as a whole increased.

Alloy steel, properly heat treated, when combined with careful designing, will accomplish much in reducing the weight of the reciprocating parts, and the net result of the reduction with one type of locomotive was that a deadweight considerably in advance of that previously possible could be placed on each axle with entire safety. At 70 miles per hour, with this locomotive, the dynamic augment of the excess counterbalance is less than 30 per cent. of the deadweight on the driving wheels, and even then the locomotive will not impose as great a stress on the track nor do as much damage to itself as is experienced with most engines which have a considerably less weight on each driving axle.

THE WEATHERING OF COAL.

MUCH has been written on the weathering of coal, says a writer in the Power User, and generally speaking it has not borne out the complaints that are made as to the capacity of weathered coal for steam raising. There are several actions at work when coal is weathered.

First, there is the actual contact of the atmosphere. When coal becomes hot in a pile it is because it is being slowly oxydized, and there is not sufficient cooling at work to keep down the temperature. Now, if coal can oxydize in this manner it is being destroyed as coal. Probably in a closely-packed heap a very small amount of heat will produce a considerable temperature, for the heat is locked in, and all accumulates until a high temperature is attained. Then, if air be admitted, the heap may fire. Some deterioration must have occurred, for a coal cannot be twice oxydized, and once it has been hot some of its calorific value has passed off. It is said also that once coal has become hot in the heap and has cooled down, it will not again become hot. It would thus appear that there may be some principle in coal which is specially ready to oxydize, that its amount is small, and that once having heated there is none left to repeat the process.

In recent years it has been observed that coal dredged up from salt water, where it has lain many years, is quite uninjured. It has been kept cold, away from contact with air, and has not been knocked about, and, we believe, steps have been taken to provide under-water storage for coal at the coaling stations of the Navy. A further advantage is that such coal ceases to be a grimy nuisance as soon as it is submerged, and also that it is effectively fenced against all possibility of fire. Various reports and papers have appeared in different publications on the weathering, heating and storing of coal but, at the moment the writer cannot locate these. Coal is probably a very complex substance, but very little is known of its actual constitution. It can be analyzed for its ultimate elementary constituents—so much carbon, hydrogen, sulphur, oxygen, nitrogen, so much silica and alumina, and small quantities of iron and other elements. If distilled at a high temperature, it will give off a certain number of products, compounds of the foregoing elements. If distilled at a low temperature, a different set of compounds are given off, but it cannot be said even that these are present in the coal. Rather they are present out of the coal.

Development of Chain Gearing for Power Transmission--III*

By H. T. Hildage

Chain gearing as a possible solution of the problem of furnishing an improved means of transmitting power to machines in factories and workshops is dealt with in the accompanying article, while a resume is also given of the progress made in design, manufacture and application as exemplified in modern installations.

THE third and concluding portion of this comprehensive article on chain gearing as a power transmission medium is here given, and deals more particularly with the considerations to be accounted in determining installation advisibility for specific conditons.

Widths of Chains and Wheels.

One of the conditions—namely, bearing area required—that influences the decision as to the width of the chain has already been spoken of. The others are the fact that there must be sufficient surface in contact between the wheel and the chain to avoid excessive wear in the wheels, and the fact that the stud must be sufficiently stiff to resist any tendency to bending, in case, from any accident or other, the contact between the chain and the wheel should become a point contact instead of a line contact.

Number of Teeth in Wheels.

It is obviously possible to make roller-chain pinions with as few teeth as may be desired, and, as a matter of fact, if the speeds are very slow indeed, and duty light, it is possible to use as few as 6 teeth. With ordinary speeds, however, the impact on small pinions becomes very great, and in general it is not desirable to use less than 12 teeth. On the other hand, it is evident, from a consideration of tooth-form design, that the adjustment for pitch extension is not so great on the bush roller as on the silent chain, and therefore it is not so desirable to use so many teeth in the large wheel. For good practice it is well to consider 80 teeth as the maximum number to be used in ordinary cases.

Application.

From the nature of the problem, and in the absence of standardization of design, it is difficult, if not impossible, to give anything more than general indications on the application of chain-gearing. In broad terms, the problem may be stated as follows:—Power is to be transmitted from one shaft to another. The amount of power is fixed, the distance between the shafts may, or may not be fixed, the speed of turning is fixed, the drive must fulfil certain definite conditions with regard to cost, uniformity of turning, noise or vibration, and space available. The questions to be answered, then, with regard to chain-gearing are:

1.—Is it adaptable for this particular case?

2.—Which type of chain is best?

3.—What will it cost?

4.—How much space will it occupy?

5.—How long will it last?

1.—There are very few considerations that absolutely rule out the practicability of using chain-gearing, and it is rather difficult to state exactly what they are. If the horizontal distance between the shafts exceeds 20 ft., chain-gearing is out of the question, unless intermediate staffs can be used.

If the direct centre distance be very great, and no adjustment for the chain can be provided, then, again, chain-gearing is not available. If it be essential that the transmission should run absolutely without attention, either automatic or otherwise, as regards lubrication, adjustment, and cleaning, then some other transmission had better be used. Other answers to this question would probably be found in answering the other questions—i.e., in certain cases chain-gearing would be ruled out on account of its excessive cost. It might be ruled out on account of the space that it would occupy, or in some cases by the shortness of its life.

2.—The following general tables will show the limitations of silent and bush roller-chain gearing as regards speeds and powers:—

Table I.—Silent Chains.

Pitch.	Range of Speeds (R.P.M.) for Constant H.P.	Maximum H.P. One Chain.
0.5	990 to 1835	4.5
0.625	790 " 1470	7.5
0.75	660 " 1225	14.5
1.0	495 " 920	32.0
1.25	440 " 735	53.0
1.5	405 " 610	75.0
1.75	375 " 485	145.0
2.25	290 " 375	270.0
3.00	165 " 270	400.0

This table is calculated on the assumption of a 17 T pinion, a maximum linear chain speed of about 1300 ft. per minute for the small pitches, and 1200 ft. for the larger pitches, and a maximum bearing pressure at these maximum speeds of about 650 lbs. per sq. in.

Table II.—Bush Roller-Chain.

Pitch.	Maximum R.P.M.	Maximum H.P.
0.5	2005	1.5
0.625	1540	1.5
0.75	1205	2.0
0.875	995	2.5
1.0	812	3.0
1.125	680	3.5
1.25	583	5.0
1.375	500	7.5
1.5	431	9.0
1.75	332	14.0
2.0	258	20.0
2.25	205	27.0
2.5	163	34.0
2.75	131	40.0
3.0	105	50.0

This table is calculated on the assumption that the minimum pinion will have 13 T. and the maximum speed is what has been shown, by long experience, to be perfectly safe.

Beyond this, the silent chain can only be used where the shafts are rotating in the same direction, but bush roller-chain can be used for a reverse drive by the intervention of a third shaft. Where noise and vibration must be reduced to a minimum the silent chain should be used; and, in general, if it be desired to reduce the noise and vibration, a shorter pitch chain, whether of the silent or roller type, will be preferred to a longer. Evenness of turning is affected by the pitch of the chain and the number of teeth in the wheels.

As has already been stated, chain-wheels are not perfect circles, but polygons, and, obviously, if the polygons have few teeth, the uniformity of turning may be sensibly affected. An example of this kind has been found in driving grinding machinery, where an emery-wheel running at a very high speed is grinding a spindle running at a comparatively low speed. If the spindle be turned by a chain-wheel having very few teeth, it is obvious that its angular velocity may vary sufficiently in a single revolution to permit the quick-running emery-wheel to leave definite marks upon it. Cases in which uniformity of turning, due to this fact, influence the drive, however, are comparatively rare.

The bush roller-chain, whilst being inferior from the point of view of mechanical refinement, and whilst not filling so well as the silent chain the general requirements of a good transmission, is of more robust design than the silent chain, will stand much more rough usage and neglect, and because of the shape of its links, can be used with smaller factors of safety, as regards strength, than the silent chain. Broadly speaking, therefore, it will be selected, by preference, where either type of chain is available, where durability and long service are more important than mechanical refinement, and where the avoidance of noise is not the most important consideration.

3.—The question of cost may involve the selection of several suitable chains, and several suitable sizes of wheels, and the making of a comparison between their prices, and no indications can be given which will be of any value in a general consideration of the problem.

4.—The question as to the space that will be occupied can be answered with accuracy when the chains and wheels have been selected. Generally speaking,

*From a paper read recently before the Manchester Association of Engineers.

a chain-drive will occupy considerably less space, both as regards width and centre distance, than belt or rope-drives, and it will occupy more space, both as regards width and centre distance, than spur gearing. It can, under certain conditions, however, be compressed into the same space, as regards centre distance, and, in a smaller number of cases, as regards width also, occupied by spur gearing.

5.—It is in seeking an answer to the question "How long will it last?" that the main problem of selecting and valuing a chain-drive must be attacked, and it involves a careful study of all the elements of the drive and all the features of the chain and wheels. A good deal of progress has been made in the application of chain gearing, and experience and information, both of a general and special character, have been obtained; but the cases in which chain-gearing have been successfully applied have varied so greatly as regards conditions that affect the rate of wear, many of which are not capable of numerical expressions, that it has not been possible to collect and tabulate the kind of information that would enable one to say when designing a new drive, how long it would last. In order to obtain a general solution of the problem, all the features have to be considered. For example, not only must the speed of the chain, the pull on the chain, or the power to be transmitted, and the angle turned by the links on the pins, length of the chain, or, what is the same thing, the distance between the shafts, the size of the wheels, the area of the bearings of the chain, and the degree and depth of hardness of the parts be considered; but the lie of the drive, the accuracy of erection, character of lubrication, the nature of the load, and other considerations may have a great if not determining, effect on the life of the chain.

What precise effect in increasing or diminishing the life, a specified change in any one of the conditions mentioned will bring about, must be determined. The degree and depth of hardness of the chain parts can, of course, always be regarded as constant. If each of the other conditions in turn remains constant, the life of the chain will be approximately inversely proportional to the chain speed, to the pull on the chain and to the angle turned by the links or by the pins in unit time; this, of course, as long as the conditions do not preclude efficient lubrication. Under the same circumstances, and within certain limits, the life will be almost directly proportional to the distance between the shafts, and to the area of the bearings of the chain. To some extent these more or less exact relationships will be varied by the effect of impact and by variation in the quality of the lubrication but it will be seen from what has been said that before any definite rules can be laid down some careful research is necessary, a large number of experiments must be made, a large number of chain-drives must be watched over extended periods; the information obtained must be carefully analyzed, due consideration being given to the other features of a chain drive which cannot be so readily expressed numerically; namely, atmospheric and temperature effects, variations in the character of lubrication, impulses in the drive, the lie or inclination in the line joining the centres of the shafts, and so on.

FAILURES OF CONCRETE STRUCTURES.

IN a recent article, says the engineering correspondent of the Daily Telegraph, London, the decay of concrete through moisture has been discussed, together with means for rendering the material waterproof. The chemical reactions causing this decay were briefly enumerated, being well understood by concrete engineers; but it has often been found that concrete structures show local patches where the surface has become quite soft, being reduced to what the chief inspector of one New York Railway euphemistically describes as "mush." Yet these parts, in common with the remaining undamaged portions, were made from the best materials, which had undergone rigid tests.

A number of bridges and tunnels on the Rapid Transit Railway, New York, were recently found to have begun to fail in spots in this way. They were all above tide level, so that the action could not be ascribed to salt water alone. It then occurred to those in charge to apply a voltmeter test to the concrete. The wet disintegrating spots proved in all cases to be carrying electric currents under pressures of from 1 to 5 volts. Dry parts showed no voltage at all, and were in excellent condition, though laid at the same time and of the same mixtures. Moreover, it seemed to have made no difference whether the concrete was laid in summer or winter, the only difference being that the failing regions had accidentally become wet.

It is well-known that wet concrete becomes a conductor of electricity, and it seems that stray electric currents from power plants, railways, etc., find their way to wet spots, and in their passage destroy the cohesion of the concrete. This process is known as electrolysis, and the simplest way to illustrate this is to pass a current between two metal plates, known as electrodes, dipped in acidulated water. The current splits the water into its constituent gases, the oxygen collects at the "anode," where the current enters, and the hydrogen is carried on to the "cathode," where the current leaves the liquid. Solutions of salts such as sodium and calcium-chlorides and the aluminium and silicon compounds found in concrete are particularly susceptible to this process of electrolysis. For any serious occurrence of electrolysis it is necessary to have the equivalents of the anode and cathode, that is, to have metal in actual contact with the concrete, also the concrete must be damp.

Electrolysis.

From this it follows that we must look for electrolysis in reinforced concrete. In such structures there are a number of steel rods in close contact with the concrete. It has often been noticed that the steel reinforcements in parts become surrounded after a time by cores of soft, discolored concrete, which is quite wet.

With the object of investigating this phenomenon and checking it, an exhaustive series of tests has been made recently at the United States Bureau of Standards, Washington. Cylindrical specimens of concrete are arranged with a metal rod as electrode embedded in each. These test specimens are placed in water in a metal jar, so that the jar and the rod can be connected up to a source of electric power, and a current may be made to flow either way by arranging the connections suitably. It is found that a pressure of 50-70 volts, causing a current to flow from the embedded iron to the concrete, splits the latter open in about twenty-three hours. The action is attributed to the swelling action of the big deposit of rust which appears on the iron, and is due to the action of the current.

The idea largely held that the concrete itself becomes deteriorated is disproved; it is merely shattered by the mechanical strength of the growing rust deposit, and the broken portions are as strong as before the test. These experiments at 70 volts are more of scientific than of practical interest, as such a heavy leakage is very unlikely to occur in a building or other structure.

Low Voltage Current Flowing From Iron to Concrete.

A very large number of specimens were tested with the embedded iron as positive electrode and voltages of 15 or less. In this case it is found that after the lapse of many months' continuous test there are no signs of splitting. The concrete on being broken open is found to be quite good and undamaged, whilst the iron is quite bright, except at the top and for about an inch below the surface. Thus, it is evident that the damage to be expected diminishes to a very small amount when the voltage is reduced to

such as one would expect to meet in practice. These remarks apply only to the case of current flowing from the iron to the concrete; when the direction of the flow is reversed, the electrolytic action tends not to corrode the iron, but rather to keep it bright. Consequently it has often been asserted that no damage will be caused by electric currents flowing from the concrete to the iron.

From Concrete to Iron.

that it can be shaved like wet pumice with a penknife. It is also discolored. During the tests it was observed that hydrogen was being evolved at the electrode, which forced its way to the top, bringing with it calcium-hydroxide in solution from the cement. This hydroxide, in contact with the air, formed calcium carbonate, otherwise chalk, on the top. The disintegration had the effect of reducing the "bond," or holding power between steel and concrete, by amounts varying up to 4-5. This is a serious matter in reinforced concrete structures.

A notable point is that this cathode effect does not diminish to a negligible amount at voltages below 10, as does the previously described anode effect.

In all the tests it was noticed that the resistance of the concrete to the flow of electric current rose more or less rapidly as the test proceeded. This rise was very marked when the current flowed from the steel to the concrete, the resistance after six months being on an average 137 times its original value. This phenomenon is one of great importance, as it shows that the concrete tends, so to speak, to arm itself against damage by automatically minimizing the cause. The explanation is that calcium carbonate is formed, as mentioned above, at the anode, and forms a film of very high resistance. With the cathode specimens, the resistance seems to be due to a film of gas round the metal. The rise is not so marked, and disappears when the gas has passed off.

Mixing Salt With Concrete.

It is the practice of some engineers when laying concrete in cold weather to add common salt or calcium chloride, either of which lowers the freezing point of the mixture thus minimizing damage due to premature setting. The Bureau of Standards strongly disadvise this practice. The salts have no detrimental effect on the concrete itself, but when a current is passed, the acid radical, chlorine, in which they are both rich, prevents the deposition of calcium carbonate, whose plugging action in the pores causes the protective rise of resistance. Moreover, it is found that both compounds materially increase corrosion of the iron.

Sources of the Trouble in Practice.

A probable and possibly serious source of danger is faulty insulation of electric leads in a building. The short-circuiting of a cable on to the concrete will not usually have very serious effects, for the area of section to carry the current away will be very large, comprising pipes and other metal fittings. There will be some softening near the footings, where the current escapes to earth, but this part being in compression and not in shear, there will be little tendency to destroy the bond of the reinforcements. Serious results may arise, however, from a good electrical contact between the reinforcements and either the positive or negative side of the cable. In the former case the potential fall near the reinforcement may be so great as to cause serious corrosion. In the latter case the concrete may soften till the bond is practically destroyed. This is probably the more serious case of the two.

Currents From Outside.

It is found that a considerable amount of leakage occurs from the return rail of electric railways. These currents find their way into buildings which are adjacent by way of pipes, lead cable conduits, and so on. If the point of contact is on the concrete, the voltage drop is so widely distributed that the damage is local, and of very small amount; but if the pipes are in metallic contact with the reinforcement, as much as 5-15 volts difference has been detected between the latter and the earth. This causes damage which is slow but sure, owing to the steady supply of electric energy at the faulty point.

It must be borne in mind that the effects described are "electrode effects." They can only occur when the concrete is in metallic contact with sources of electric energy, and when it is damp. These conditions make the precautions to be taken self-obvious. All parts of the structure, particularly below ground level, must be made waterproof as far as possible. Much benefit may be derived from placing layers of cotton treated with pitch under the foundations and round the basement walls. This material has a high electric resistance as well as being a waterproofing medium. Even after the latter property has weakened with lapse of time the former remains of much advantage. Much good may be done by supporting the footings on granite, which, when wet, does not become a conductor to anything like the extent that concrete does.

Insulations.

Great care should be taken to ensure that all electric wires are efficiently insulated, periodic tests being made for faults. It has been mentioned that pipes and cables entering the building are a serious source of trouble. This may be removed by inserting joints of insulating material, such as china, just before the point of entry. If a pipe or cable passes through the building, such insulating joints should be inserted at entry and exit, thus protecting the building.

PROBLEM OF THE THRUST BEARING.

HENRY T. NEWBIGIN in a recent paper read before the Institution of Civil Engineers, drew attention to the inefficiency of thrust bearings as compared with journal bearings and their disadvantages, especially in high-speed machinery. A comparison was made between Coulomb's laws of friction and the late Professor Osborne Reynolds's hydrodynamic theory of lubrication, and coefficients of friction in bearings of various forms were given, while the way in which the friction in a journal bearing changes from dry or greasy friction to perfect lubrication as the speed increases was also discussed. The late Beauchamp Tower's discovery of liquid pressure in the oil-film was described.

Viscosity was defined, and the resulting general formula compared with the results of Mr. Tower's and Professor Goodman's experiments. The conditions necessary for the maintenance of liquid pressure in an oil-film were also examined and defined.

The subsequent developments of Reynolds's hydrodynamic theory of lubrication were referred to, and A. G. M. Michell's formulae for the resistance of lubricated plane surfaces were cited: the paper concluding with description, illustrations and the results of tests of thrust bearings constructed on Michell's principle.

Vanadium in Brass. A paper entitled "Vanadium in Brass" was read recently by Messrs. R. J. Dunn and O. F. Hodson before the Birmingham Section of the Institute of Metals. The work which the authors had carried out was designed to ascertain if small percentages of vanadium had any effect on the constitution and structure of copper-zinc alloys, and the conclusion was that, on the whole, annealing appeared to have rather less effect on vanadium brasses than on pure brasses. It was probable that the beneficial effect of vanadium was largely due to its deoxidizing power, but in that and in other respects it was difficult to estimate the exact effect of vanadium owing to the comparatively large amounts of aluminum and other metals present in many samples of commercial cupro-vanadium.

Development, Application and Testing of Pneumatic Tools-II*

By H. I. Brackenbury

Pneumatic appliances and apparatus adapted to one or more stages in the manufacture of mechanical and general industrial products determine by their installation in a plant, just to what extent the management of the latter are keeping pace with the progress and development being made in this particular sphere. Applied compressed air claims equal classification with electricity in the revolutionizing of manufacturing methods.

PART ONE of this article dealt more particularly with the historical side of pneumatic tool equipment. In the present instance the practical adaptation of this type mechanism is featured at considerable length: being therefore of rather more direct interest to those already taking advantage of the service rendered and to others prospective.

Tierney Chipping and Riveting Hammers.

Figs. 6 and 7 show the Tierney chipping and riveting hammers, and it will be noticed, although there are differences in sizes, the principle involved is the same for both classes of hammer. The design is of an exceptionally simple nature, the valve having but one working diameter, and being made in a form which give it strength combined with lightness. The piston enters into the valve, so that practically the maximum length of stroke for the length of hammer is obtained. The working of the hammer is as follows:—

Air is admitted to port (B) by pressure of the lever (A) and so to (C), and through the restricted passage (D) to the back of the valve. In the position shown, pressure acts between the piston and the front of the valve, while constant live air at the rear of the valve is open to exhaust through ports (H), (G) and (E). The piston thus travels down the cylinder, while air that would otherwise be trapped between the piston and the chisel passes through (L) to the groove (M) in the valve, and so to exhaust through (N). The piston having now uncovered (E) to the live air, pressure is released from it and the front of the valve, while the constant live air at the back of the valve being closed to exhaust by the piston, now drives the valve to its forward position. Live air now passes through (C) round the groove (O) in the valve to port (K), and so to the end of the cylinder, and the piston is driven up towards the valve. Upon uncovering port (E), pressure is released, and also the pressure on the back of the valve is released through (G), while the air trapped between the piston and the front of the valve forces it to its backward position.

*From a paper read recently before the Coventry Engineering Society.

Considerations Regulating the Design.

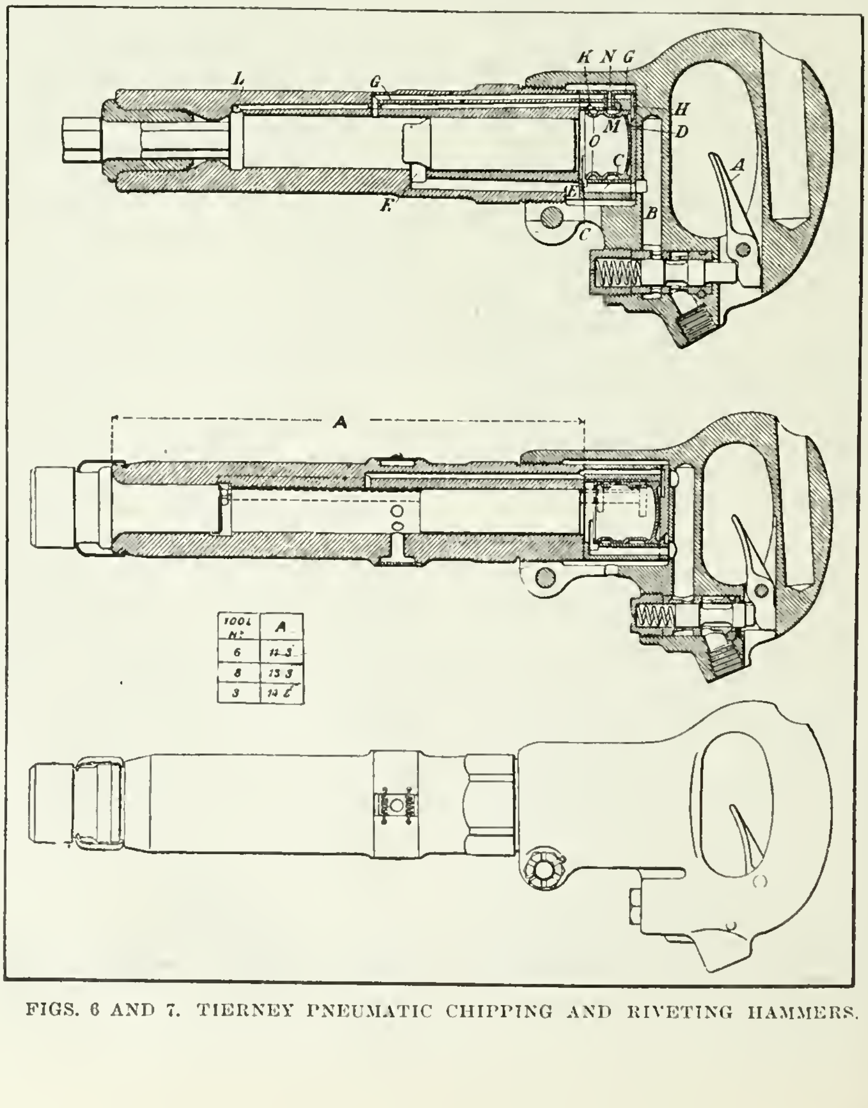
The problems presented to the manufacturer of pneumatic tools differ considerably from those involved in the production of other machines actuated by a fluid under pressure. The relative importance to be attached to the desirable qualities of reliability, efficiency, lightness, power and cheapness, which so often prove to be, to some extent, mutually antagonistic, is a matter to be decided only after long experience. Such experience, however, is useless unless it be accompanied by a clear understanding of how these qualities are interrelated. It is proposed, therefore, to undertake a slight investigation of the limitations under which the designer of pneumatic tools of necessity must labor, and then to consider the methods by which he may gauge the value of his product.

Before proceeding further, it may be well to say that the type of successful pneumatic tool is necessarily that which appeals to the purchaser, so that in the end it is his experience and wisdom to which we must look for the insistent demand for improvement in these tools. If the author can indicate some directions in which such improvements may be reasonably expected he will have succeeded in the purpose of this paper.

The desirable qualities in a pneumatic tool in their order of importance appear to be: Reliability, power, cheapness, lightness, ease of handling and compactness, and low air consumption.

The Air Consumption Feature.

Up to the present probably too little importance has been attached to the last of these desiderata. It is no uncommon thing to find a large and expensive air-compressor plant eating up power and



FIGS. 6 AND 7. TIERNEY PNEUMATIC CHIPPING AND RIVETING HAMMERS.

delivering enormous volumes of air to supply the incessant drain of leaking pipes and hose, and the intermittent demands of most wasteful types of tools. This fault is largely due to the infrequency with which the supply of air is measured. There are now on the market several types of instruments which will indicate the rate of flow of air with reasonable accuracy, although the price asked for them at present is rather high, owing, no doubt, to the small demand.

The author has used for some years a form of Venturi tube, connected to a U-tube manometer, and provided with a scale which corrects for pressure. A very similar instrument has since been placed on the market, and the general use of some such device should do much to initiate a demand for improvements in pneumatic tools. Perhaps it would be no exaggeration to say that quite generally the amount of air lost by leaking hose is almost equal to that used by the pneumatic tools themselves. The leak can be easily found by testing at meal hours, when the pneumatic tools employed will not be in operation, but the leak will be unaffected if the compressor plant be kept running. Without doubt the convenience and reliability of these tools fully justify their employment even under present conditions, but the following consideration may induce those that employ them to exercise greater vigilance in avoiding waste.

Avoidance of Air Waste.

Suppose that there are a number of leaks equivalent to a circular hole of about 1-10 in. in diameter—a case that would be only too easy to discover. If the air supply be 100 lb. per sq. in. pressure, the air leak will be about 15 cubic feet of free air per minute, or about 2 cubic feet per minute of the compressed air. The power required to compress this will be nearly 3 horse-power, so that the cost of the leak would waste about 120 cubic feet of compressed air per hour, costing about 32 cents per thousand cubic feet, or nearly as much as what is paid for coal-gas.

An inverted Welsbach burner consumes about 4 cubic feet of gas per hour, and gives at least 50 candle-power after having been used for some time. No manager would allow the wasteful burning of thirty such burners giving more than 1,500 candle-power, yet the equivalent leak of compressed air often passes unnoticed and unreproved. If a leak of compressed air were unpleasant or dangerous, it would be more likely to be rectified. As a matter of fact, this system of power distribution suffers from its very safety and innocuous character.

Pneumatic Drilling Machines.

The factors governing the design of pneumatic-drilling machines are entirely different from those for fixed machines.

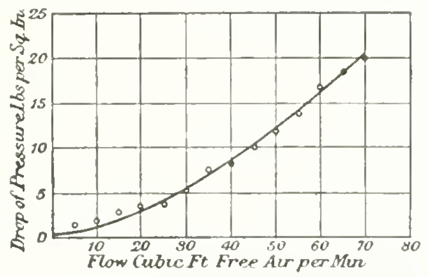


FIG. 9. DROP OF PRESSURE ALONG 16.5 FT. OF FLEXIBLE ARMOURED HOSE. ½ IN. DIA. BORE. INITIAL PRESSURE 85 LBS. PER SQ. IN.

In the latter case the machine is designed to run the drill at the speeds and feeds which will give the quickest penetration without undue wear to the drill. In the case of the pneumatic drill, the power is the governing factor, and, therefore, the design must be such as to use that power to the greatest advantage—i.e., to rotate the drill at the speed at which the greatest penetration is

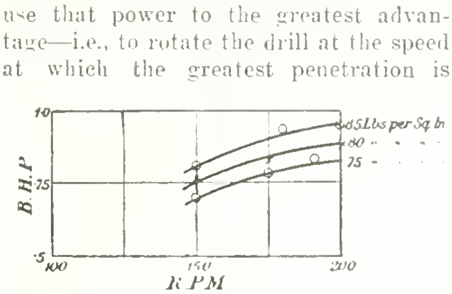


FIG. 10.

given for the power. This speed is a slow speed, and not a high speed.

The author found, without going to any extreme limits, that an ordinary drilling machine required, for the same rate of penetration with fast speed and fine feed, double the power required with slow speed and coarse feed, Fig. 8. This figure is taken from a paper by Mr. Dempster Smith, entitled "Experiments upon the Forces Acting on Twist Drills,' read before the Institution of Mechanical Engineers in 1909. The curves show the torque and thrust of a 2-in. drill entering, fully entered, and with the feed disengaged.

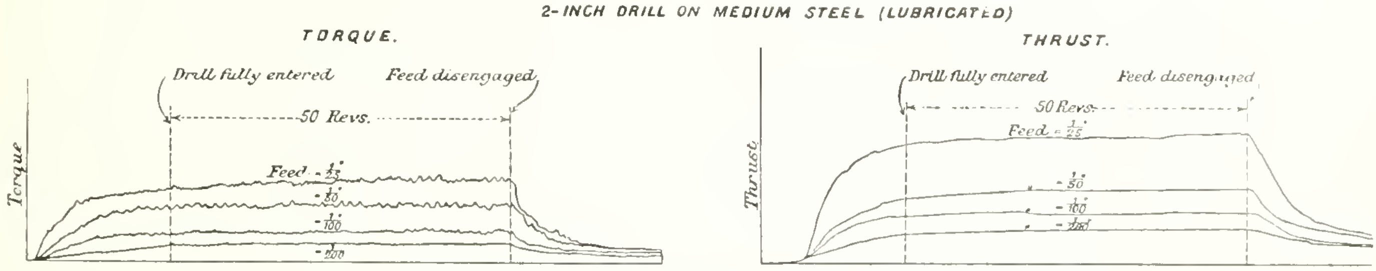


FIG. 8. DIAGRAM OF POWER CONSUMED BY A DRILLING MACHINE.

It will be noticed what a very large proportion of the power used for the finer feeds goes in friction when the drill is not cutting. These experiments were made with a drill in careful alignment with the work, and not, as may often be the case, with a pneumatic drilling machine supported by a springing arm and starting with the drill at anything but right angles to the surface of the work; conditions which would tend to increase the drill friction.

The result, as will be shown by what follows, is that the best effects are obtained by running the drill at slow speeds, and not at high speeds. The limit in this respect would be reached if the pressure required to feed the drill were more than could be conveniently given by the feed-gear, or if the torque exceeded the strength of the drill-body or cutting edge.

Fig. 9 shows a curve of the drop in pressure in a flexible hose 16½ ft. long and ½ in. diameter bore, with initial pressure 85 lbs. per square inch. It will be noted that at a flow of 70 cubic feet of free air per minute there is a drop of 20-lb. pressure per square inch. The flow of air was measured by means of a Venturi tube connected to a U-tube manometer, provided with a scale corrected for variations in the initial pressure of the air.

Now, it is evident that this drop in pressure has a very important bearing on the design of the tool, and may be employed to advantage. Let us take as an example the tests of a pneumatic drilling machine connected to the main supply by a length of 16½ ft. of hose of ½ in. internal diameter. As shown by table I., if the drill uses 70 ft. of free air per minute, and the pressure of air on entering the hose is 85 lbs., the pressure at the drill will only be 65 lbs.

When the air is allowed to flow into the drilling machine, a high speed of rotation is set up until the feed is applied by the feed-screw. The more rapidly the feed-screw is rotated, the quicker will be

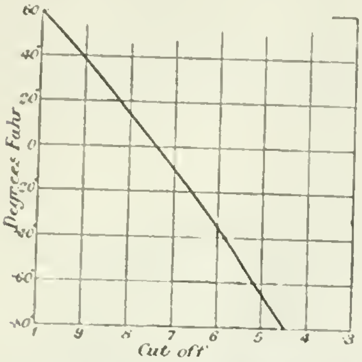


FIG. 11. TEMPERATURE AT EXHAUST WITH VARYING POSITION OF CUT-OFF, ASSUMING INITIAL TEMPERATURE 60° F., AND ADIABATIC EXPANSION OF PURE DRY AIR.

the penetration of the drill and the slower will the drill rotate, with the final limitation that if the feed is too rapid, the drill will stall suddenly and there will be no penetration.

This appears to be a curious paradox, for, apart from considerations of wire-drawing, the indicated horse-power of the pneumatic engine would seem to be dependent on its speed and the pressure of the air. Fig. 10. Since, however, the flow of air is decreased at the slower speed, the pressure rises and the torque increases. The result arrived at, therefore, is that the maximum speed of penetration is given by that speed of rotation at which the machine develops its minimum horse-power, but its maximum stable torque.

Considerable experience of running drills under test conditions has proved the importance of applying the feed with judgment. A man used to this work can get much better results out of a drill than can another man, equally intelli-

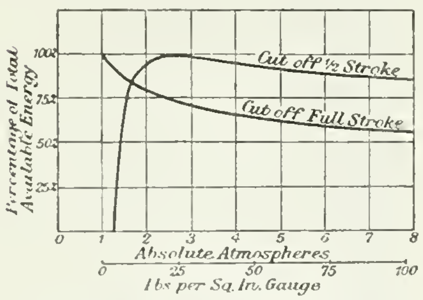


FIG. 12. PERCENTAGE OF AVAILABLE ENERGY USED WHEN WORKING NON-EXPANSIVELY WITH COMPRESSED AIR, AND WITH CUT-OFF AT HALF-STROKE.

gent and skilful, who is not so accustomed. It requires the greatest judgment in order to feed the drill so rapidly that it shall just, but only just, escape stalling. It has been found that the feed must be reduced slightly just before the drill breaks through the metal.

Perhaps at this point it may be well to mention that the above considerations apply only to those cases where the power given by the pneumatic tool is less than that which can be used by the twist-drill without requiring to be ground too frequently. With modern high-speed twist-drills of ½ in. diameter and above, this is practically always the case.

The idea of a minimum speed at which the pneumatic drill will run without stalling is of importance, because it should help to fix the gear ratio to be employed between the pneumatic motor and the twist-drill. As already shown, this critical speed is probably dependent not only on the size of the twist-drill and the material to be cut, but also upon the laws connecting the torque of the pneumatic motor with its speed of revolution, while this relation in its turn depends upon the pressure of air supply and the length and bore of the flexible hose.

However, let us consider for he moment that the critical speed is a constant, and is known. Let us suppose that it is 200 revolutions per minute. Then, if the relation of the horse-power of the pneumatic motor to its speed of revolution be known, the gear ratio may be designed so that the motor shall give out the maximum horse-power when the twist-drill is running at 200 revolutions per minute.

The history of other prime movers would indicate the probability that there will be, and should be, an increase in the number of revolutions of the pneumatic motor on drills. The advantages obtainable by such a change are almost self-evident. Everything is to be gained by obtaining increased power from the same piston by running it faster, provided the design still ensures reliability and good wearing qualities. However, if this change occurs, it will necessarily involve an increase in the gear ratio between the drill and pneumatic motor.

Perhaps it may be allowable here to point out a contrast between the humble "windy drill" and its more lordly cousin, the motor-car engine. In both cases the desire has been to get a larger output of power from a given size of engine; but, while the motor-car engine has been set to drive its attached machine at ever-increasing speeds, the unfortunate pneumatic engine is doomed to rotate its twist-drills at the minimum stable speed as long as the man in charge takes the trouble to work it at its full capacity. If the bore and stroke of the engine be fixed, the gear ratio should, therefore, be higher or lower, according as the maximum power is developed at a high or low speed.

It may be said that all pneumatic drills which are operated by pistons and crank-shafts at present run at very low piston speeds—indeed, lower than most slow-speed, steam engines. As in the case with the petrol engine, the difficulty is to get adequate valve area.

We have already seen how important is the effect of skill in feeding a pneumatic drill in order to make it give the best results. Let us trust that the future has not in store for us both professional racing drillers and specially-designed racing drills. However, if such be the case, we must picture to ourselves a machine with enormous valves and an abnormal gear ratio, so as to enable the pneumatic motor to run at an excessive rate while the twist-drill, fed downwards by a powerful feed motion, rotates at the lowest possible speed at which its motion is stable.

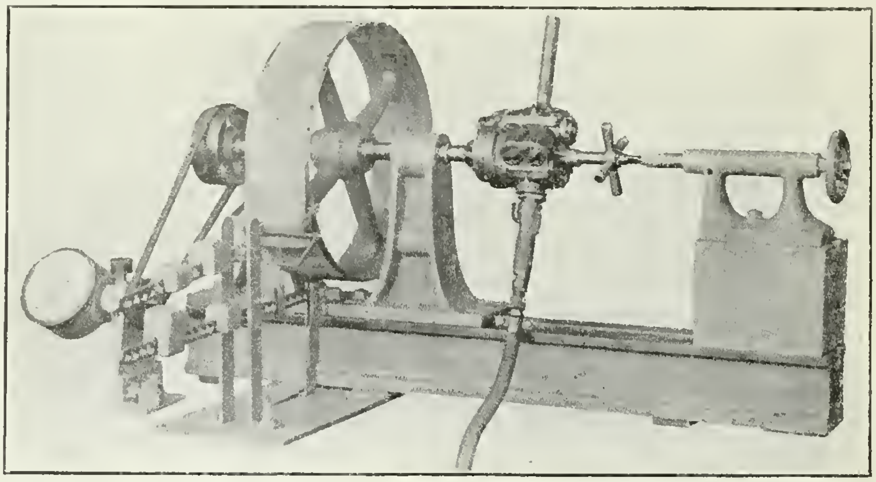


FIG. 13. DYNAMOMETER BRAKE FOR TESTING PNEUMATIC DRILLS

Table I.

Flow cub. ft. per min. of free air.	Drop lbs. per sq. in.
5	1.5
10	2.0
15	3.0
20	3.3
25	4.0
30	5.5
35	7.5
40	8.5
45	10.0
50	12.0
55	14.0
60	16.8
65	18.5
70	20.0

PRESSURE DROP IN ARMOURED FLEXIBLE HOSE, 16½ FT. LONG, ¾ IN BORE, WITH 85 LBS. PER SQ INCH INITIAL PRESSURE.

Page-Hersey Co. New Butt-Weld Pipe Mill, Fort William

The Fort William plant of the Page-Hersey Co. represents a faith in the increasing pipe and tube requirements of the Dominion of Canada, and is a tangible expression of their desire to meet the needs of our Canadian West, not only in kind and quantity, but in prompt delivery.

THE new plant of the Page-Hersey Iron, Tube and Lead Co., Ltd., at Fort William, Ont., is practically completed. This company now have three plants making butt-welded pipe—one at Guelph, Ont., the one mentioned above, and one at Welland, Ont. In addition to these plants making butt-welded pipe in sizes from ⅛-in. to 4-in., they have a lap-weld pipe mill at Welland, Ont., making lap-welded steam and line pipe tubing, drive pipe casting, also bell and spigot pipe, in all weights and in sizes from 2-in. to 10-in. They are also equipped to supply trolley poles, tarred and wrapped pipe and special bends. With the three mills, the company is in a position to furnish anything in the tube line, either standard or special on short notice, and with their improved equipment to guarantee that the output is of excellent quality. The Fort William plant represents a faith in the increasing tube trade in Canada, and the desire to supply their Western customers with quick delivery, by establishing a distributing point for the larger sizes of pipe, at which place a large stock will be constantly kept on hand.

The plant at Fort William is located at the corner of Montreal street and Neebing avenue, and has a fronting on the Kaministiquia River with dock facilities. The property comprises about twelve acres, and is reached by an industrial spur connecting with the G.T.P., C.P.R., and the C.N.R. The plant when running at full capacity will employ about 250 men.

Buildings.

The designs for the plant were executed in the company's engineering department at Welland, and the erection of the buildings was done by local contractors. The installation of all the machinery was under the direct supervision of the company's engineering department. The buildings comprise a producer and boiler house, 30 ft. x 60 ft.; a furnace building 70 ft. x 140 ft.; a finishing building, 70 ft. x 180 ft.; a galvanizing department, 40 ft. x 125 ft.; a machine shop, 38 ft. x 100 ft., and a pipe storage building, 60 ft. x 406 ft. All the buildings are of brick construction, except the producer house, galvanizing department, and pipe storage, which are of wood framing, sheeted and roofed with corrugated iron.

Skelp Yard.

The skelp yard is equipped with crane runway service, 440 ft. long, and a 10-ton crane of 70 ft. span. The skelp is transferred from the yard to the furnace by means of an industrial track system. The yard has sufficient storage capacity of plate for the various sizes of pipe made, and to meet the demands of rush orders of any nature.

Furnace and Welding Machinery.

The furnace is of the regenerator type, 8 ft. x 24 ft. hearth, and gas for heating same is supplied by three 10 ft. diameter stationary producers, hand stoked. In the boiler house is installed one Barrow combination boiler, which furnishes draught for the producers and supplies heat for the various buildings. A pair of clipping shears for forming and trimming the ends of the skelp, is located at the charging end of the furnace, and is operated by a Canadian-Westinghouse motor. These shears and the machinery for drawing the skelp from the furnace and welding same, the various rolls for sizing the welded pipe, and the movable racks for cooling the pipe, were all designed by the company's engineering department. This machinery is also all operated by Canadian Westinghouse motors.

Finishing Department.

The handling of the pipe from the welding department to the pipe storage, following the sequence of the different operations in the finishing of the pipe, is accomplished with trucks, equipped with roller bearings running on a track of 30-in. gauge.

There are twelve threading machines in this department, arranged in pairs. They are of improved design, insuring perfect threading and reaming of all pipe. One pair of the larger machines is equipped with a coupling screwing-on arrangement. The other five pairs of machines each have a separate mechanism to take care of this feature of the work. The machinery in this department is all belt driven.

All the pipe is given a thorough hydraulic test, for which is provided a 600 lbs. pressure triplex power pump, with individual motor, and an accumulator and intensifier to increase the pressure to 2,000 lbs. All pipe is given a test of from 400 lbs. to 2,000 lbs. depending on the requirements. The testers consist essentially of a bed 25 feet long, with a fixed head and movable tail stock, between which the pipe is held end to end and filled with water at the test pressure. From these testers the pipe goes to the measuring and bundling bench, and thence to the pipe storage, where it is loaded directly for shipment or put into stock.

Galvanizing Plant.

This department comprises pickling tanks, for removing all scale or foreign matter preparatory to the galvanizing process; dryers for drying pipe before immersing in the spelter bath; the spelter bath itself and drawing machinery for affording a clear, even exterior surface, and leaving the inside clear and smooth of all obstructions. The pipe in this department is handled by means of an underhung crane with two two-ton electric hoists, affording flexibility in handling, such as tipping the pipe for drainage.

The Machine Shop.

The machine shop building is a two-storey structure, the first floor being used for the mechanical department, and the second as a carpenter shop. The equipment of the shop is as follows:

1 22-in. engine lathe.
1 12-in. Cisco engine lathe.
1 Bertram shaper.
1 Radial drill press.
1 Mackenzie hack saw.
1 Norton grinder.

The forge shop is located in the welding department, while space 30 ft. x 38 ft. of the machine shop building is used as a transformer house, etc., the equipment being as follows:

3 panel slate switchboard, 65 in. x 30 in. x 2 in.

1 55 k.v.a. 1,200 r.p.m. synchronous motor direct connected to one 35 k.w. 250 volt compound wound, interpole generator.

3 75 k.v.a. oil insulated self-cooling, single phase, 60 cycle transformers; primary 220,000 volts, secondary 550 volts.

All of the above is of Canadian Westinghouse Co., Hamilton, manufacture.

Pipe Storage.

An industrial spur enters this building as a depressed track, and is paralleled by two tracks of 30-in. gauge, with storage racks on either side of the latter. By this method, loading from stock, or directly from production is possible with speed and ease.

The couplings for all the plants of the company are made at the Welland works, in order to insure absolute uniformity of product. The equipment there being of the latest type for welding and tapping. Couplings of all sizes.

tapers, recesses, and threads are made, including steam, line, drive, regular casings, and inserted joint casings.

All the pipe made by the Page-Hersey Iron, Tube and Lead Co., bears the trade mark, P crown H. rolled on each length of pipe. They are pioneers in the Canadian pipe industry, and their head offices are at the Traders Bank Building, Toronto, Ont.

U.S. PIG IRON PRODUCTION IN 1913.

THE total production of all kinds of pig iron in 1913, according to the Bureau of Statistics of the American Iron and Steel Institute, amounted to 30,966,301 gross tons, against 29,726,937 tons in 1912, an increase of 1,239,364 tons, or over 4.16 per cent. The production in 1913 was the largest in any previous calendar year. Combining the output in the first six months of 1913 with the output in the last six months of 1912, however, a total is reached for the twelve consecutive months of 32,143,265 tons, or 1,176,964 tons more than in the calendar year 1913. The following table gives the production of pig iron in half-yearly periods from 1910 to 1913, in gross tons, including several thousand tons of ferrophosphorus, ferrotitanium, ferrovanadium, and other alloys:—

	1910	1911	1912	1913
1st half	14,978,738	11,666,996	14,072,274	16,488,602
2nd half	12,324,829	11,982,551	15,654,663	14,477,699
Total	27,303,567	23,649,547	29,726,937	30,966,301

The production in the second half of 1913 shows a decrease of 2,010,903 tons, or almost 12.2 per cent., as compared with the first half.

Classified Production.

The production of Bessemer and low-phosphorus pig iron in 1913 was 11,593,385 tons, against 11,664,015 tons in 1912, a decrease of 70,630 tons, or about 0.6 per cent. In the second half of 1913 the production of Bessemer and low-phosphorus pig iron was 5,307,419 tons, as compared with 6,285,966 tons in the first half. The production of low-phosphorus pig iron alone in 1913 was a maximum, and amounted to 316,818 tons, as compared with 282,359 tons in 1912.

The production of basic pig iron in 1913, including a small tonnage of charcoal pig iron of basic quality, amounted to 12,537,746 tons, against 11,417,886 tons in 1912, an increase of 1,119,860 tons, or over 9.8 per cent. In the second half of 1913 the production was 6,027,735 tons, against 6,510,011 tons in the first half, a decrease of 482,276 tons. The production in 1913 was much the largest yet achieved, the year of next largest production being 1912.

The production of charcoal pig iron in 1913 amounted to 339,981 tons, against 347,025 tons in 1912, a decrease of 7,044 tons. A small quantity of pig iron made with charcoal and electricity is included in the figures for both years. In the first half of 1913 the production of charcoal pig iron amounted to 176,182 tons, and in the second half it amounted to 163,799 tons. No pig iron was made in 1912 or 1913 with mixed charcoal and coke as fuel.

The production of spiegeleisen and ferromanganese in 1913 amounted to 229,834 tons, against 221,724 tons in 1912, an increase of 8,110 tons. The production of ferromanganese alone in 1913 amounted to 119,496 tons, against 125,378 tons in 1912. Of spiegeleisen alone the production amounted to 110,338 tons in 1913, against 96,346 tons in 1912. In addition to the above, 3,332 tons of ferrophosphorus were produced in 1913, against 6,697 tons in 1912.

The production of bituminous coal and coke pig iron in 1913 reached a maximum of 30,348,973 tons, as compared with 29,132,733 tons in 1912, an increase of 1,216,240 tons, or about 4.2 per cent. In the first half of 1913 the production was 16,107,845 tons, and in the second half 14,241,128 tons.

The production of mixed anthracite and coke pig iron in 1913 amounted to 254,901 tons, as compared with 236,467 tons in 1912, an increase of 18,444 tons. In the first half of 1913 the production amounted to 193,084 tons, and in the second half it amounted to 61,817 tons. The production of pig iron with anthracite coal alone in 1913 amounted to 22,446 tons, as compared with 10,712 tons in 1912.

Furnaces in Blast and Building.

The whole number of furnaces in blast on December 31, 1913, was 205, against 304 on June 30, 1913, and 313 on December 31, 1912. The number of furnaces idle on December 31, 1913, including furnaces being rebuilt, was 257, against 160 on June 30, 1913, and 153 on December 31, 1912. The number of furnaces actually in blast for a part or the whole of the last six months of 1913 was 330, against 348 in the first half of the year. In the last half of 1912, 337 furnaces were active, against 302 in the first half.

On December 31, 1913, there were three entirely new furnaces in course of construction, all of which will use coke fuel, as follows:—Pennsylvania, 1, and Minnesota, 2. They will have a total annual capacity of 505,000 gross tons of pig iron. In addition, eight furnaces were being rebuilt on that date.

In 1913 there were five entirely new furnaces built, four coke and one charcoal, with an annual capacity of 596,000 gross tons, as follows:—Pennsylvania, 2; Virginia, 1; Ohio, 1, and Mississippi, 1 (charcoal). In addition, one charcoal furnace in Georgia, with an annual capacity of 13,500 tons, was revived.

During 1913 there were 10 blast furnaces abandoned or dismantled, with a total annual capacity of 316,000 gross tons, as follows:—New York, 1; Pennsylvania, 4; Virginia, 2; Tennessee, 1; Ohio, 1, and Michigan, 1. When last in blast, two furnaces, with an annual capacity of 29,000 tons, used charcoal, and eight furnaces, with an annual capacity of 287,000 tons, used mineral fuel. Some of these furnaces had been idle for many years.—Iron Age.

MODERN GEARING.

MR. H. HUBERT THORNE, in a paper read before the Junior Institution of Engineers recently on Modern Gearing, said: The subject had not received the serious consideration of many engineers, partly because of the belief (due to the very indifferently manufactured gears of even recent date) that all gears were inefficient, and partly because a very considerable amount of time must be given over to test and study if the subject were to be mastered. The involute possessed advantages over the cycloidal tooth for general use, as the centres of a gear could be varied to some extent, and still the latter would mesh properly. All that happened when the centres were extended was that the pitch point was moved nearer to the outside of the teeth, the pitches being correspondingly increased. This was a very useful property of the involute, and today this form was almost universally used; so, when speaking of gears, he would consider only involute gears.

The introduction of high-speed motors and the general speeding-up of machinery introduced new problems to the engineer, and he set about to find a gear which would run at a high velocity without undue noise and vibration, and one which would give a fairly high ratio of reduction in a single pair of wheels. Two ways of getting over the difficulty presented themselves—one by using pinions of special materials which would not create noise when running with metal wheels, and one by altering the form of the teeth. The former method was adopted for many drives, and pinions of raw hide, compressed paper, compressed linen, fibre, etc., had all been tried, but on account of the large diameters necessary to accommodate rivets between the bottoms of the teeth and the bore, the wheels became unduly large and heavy, and the ratios obtainable only small. The latter method had also been largely adopted, particularly within the last decade, and had resulted in the develop-

ment of two distinct forms of gearing—the first worm gearing, and the second double helical gearing.

Worm Gearing.

Worm gearing was quiet in operation, and could be made with ratios as high or even higher than 100 to 1, but owing to the fact that the rolling action of the correct spur gear gave place to a rolling and rubbing action between the worm and the wheel, the speed of the worm must not exceed comparatively low limits, determined by the conditions under which it had to work; and, further, the efficiency went down as the ratio increased, and a high ratio worm gear was not by any means an efficient mechanism. The reasonable adoption of worm gears was consequently restricted to comparatively small powers, speeds and ratios. For such gears, having both shafts mounted in ball bearings, efficiencies of 95 per cent. were readily obtainable.

Helical Gearing.

For high powers and speeds some other form of gear must be looked for than worm gears. The single helical gear possessed the great disadvantage that end thrust was set up along the shafts (a disadvantage also inherent in worm gears), and to overcome this, two single helical gears of opposite hands were riveted or bolted together, thus forming the double helical gear. This type of gear, which was not now built up from two single helicals, but cut direct from the solid blank, was often manufactured with a ratio of 25 to 1 in a single reduction.

By comparison, the variation of stress on the teeth was very much less with the double helical than with the straight tooth, and consequently the former was the stronger. With double helical gears the average engagement was spread over an area, the limits of which were comparatively near the pitch line, and the action became more nearly a pure rolling one, and the rubbing action, which must produce wear, was reduced to a minimum.

With spur gears, particularly when the pinion had only a few teeth, a distinct knock was noticeable, as the load was repeatedly applied along the whole length of the tips of the teeth, whereas with double helical gears, however small the number of teeth in the pinion, the engagement at the top of the tooth could only occur at a particular point or points of the face at any one time, the average engagement being always near to the pitch line. Owing to the elimination of most of the losses due to sliding friction, practically the whole power put in was transmitted through the gear, and from actual tests it was ascertained that with a ratio of 20 to 1 in a single train, the efficiency was 98½ per cent.

Many double helical gears were now running at ratios of 25 to 1 and over, the only limiting factors being the diameter at the root of the pinion teeth, necessary to resist torsion and bending, the capacity of the machine on which the wheel was to be cut, and the space available. The diameter of the pinion was only limited by the necessary root diameter, because, as previously stated, by suitably increasing the face width of the pinion any desired number of teeth would be in engagement at one time.

BOILER EXPLOSION AT OTTAWA.

A DISASTROUS boiler explosion occurred on the morning of January 21 at the Howick Hall, Ottawa, when three men were killed, five severely injured, and several valuable horses perished. The Eastern Ontario Live Stock Show was being held at the time, which accounts for the presence of the horses. The hall is a steel and concrete structure, with an annex, about 150 yards square at one end, built of wood. It was under this section that the boiler and heating plant were located.

The boiler was of the return tubular type, 60-inch diameter by 14 ft. long, and had 82 3-inch tubes. It was made of Carnegie steel plate of 60,000 T.S., 5-16-inch thick, the heads being ⅜-inch thick with 1⅛-inch longitudinal stays. The longitudinal seams had double riveted lap joints with ¾-inch rivets, 2⅞-inch pitch. The girth seam was a single-riveted lap joint having ¾-inch rivets, 2 1-16 inch pitch. The safety valve was of the lever and ball type, 3½-inch diameter. The boiler failed at the manhole ring, which was of cast iron, and through the front shell plate in a longitudinal direction.

At the official enquiry, held to investigate the cause of the explosion, the jury brought in a verdict to the effect, "that the explosion was caused by excessive steam pressure and that the safety valve and steam gauge were defective." According to the specification, the boiler was good for 65 pounds working pressure, but it had been operated at a lower pressure, usually around 20 pounds, and was used for supplying steam to a low pressure heating system. We are indebted to Mr. D. M. Medcalf, chief boiler inspector of the Province of Ontario, for the constructional details and accompanying photographs. Mr. Medcalf made an examination of the wrecked boiler on behalf of the Provincial Government.

Cleaning Producer Gas.—The cleaning of producer gas by straining it through a porous diaphragm of fine-spun glass was recently described before the American Society of Mechanical Engineers in a paper by Mr. H. F. Smith. Both gas and tar pass through the diaphragm, but in passing, the tar particles coalesce into large drops which cannot be carried along with the gas current. By means of this process any desired degree of gas cleanness can be secured. Water or other washing fluid is not required, and the process is not one of filtration.

Mechanical Stoking of Locomotives.—It was inevitable that when a satisfactory mechanical stoker for large locomotives was developed, it would have extended application. We understand that one large locomotive stoker Company has at the present time over 400 stokers in regular operation on locomotives in the United States, and that 200 of these are in use on the Baltimore & Ohio Railroad.

REAR SECTION OF BOILER AFTER EXPLOSION

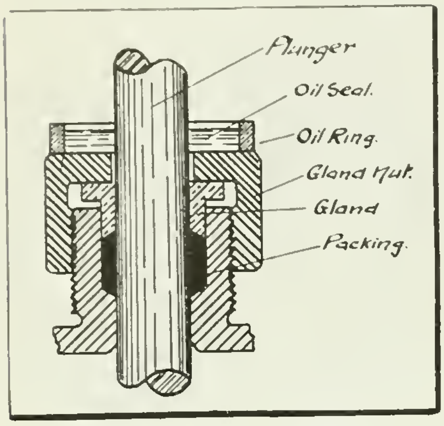
MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

MAKING PACKING AIR TIGHT.

By N. G. Near.

HAVE you ever had trouble keeping the packing of a hand pump perfectly air tight? Where the packing is leaky, you usually have a hard time making the pump "catch" without priming it. Here is a simple method for assuring air-tightness—make an oil-seal.



MAKING PACKING AIR-TIGHT.

An oil ring can be easily attached to the stuffing box cap by sweating on, or in a hundred other different ways; all that is necessary being to make the joint leakless. Pour in a fairly heavy lubricating oil, and as long as any of the latter remains in the cup you have thus fashioned, you may be assured that the packing is tight. If gasoline be the liquid pumped, lubricating oil will not harm it, in fact, lubricating oil is a good thing to mix with gasoline for use in connection with reciprocating gasoline engines.

TENSION ON CYLINDER COVER STUDS.

By J. Roy Brodie.

IN the February 5 issue of **Canadian Machinery** there appears a question which I believe was up for discussion some years ago. Mr. Jones, who was the originator of the problem, thought there would be no increased tension on the studs till the steam cylinder pressure exceeded 100 lbs. per square inch. Now, if the above pressure causes increased strain, I cannot understand why any pressure lower would not have the same effect in proportion.

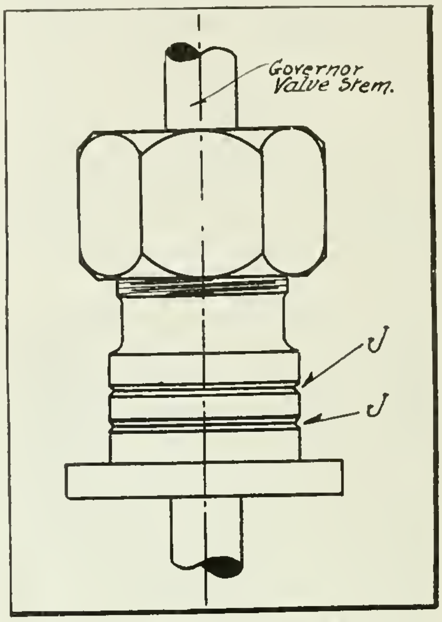
I do not consider it necessary to explain my theory with diagrams for the reason that I agree in every particular with the theory of Mr. J. H. Rodgers, but will add a little to his theory with the hope that it may aid in a more thorough explanation of the question before us. For instance, let us suppose the face plate was secured to the flange by studs having a tensile strength of 50,000 lbs. per square inch or sectional area, and if each bolt had a sectional area of a ½ square inch, the total strength of each bolt would be 25,000 lbs. With ten bolts, the total resistance to strain would be $25,000 \times 10 = 250,000$ lbs. The pressure exerted on each stud bolt by screwing up the nut being 1,000 lbs., therefore, on ten bolts the total pressure would be 10,000 lbs. The total pressure of steam on the face plate would be 100 sq. in. $\times$ 80 lbs. per sq. in. $= 8,000$. Deducting the combined effective forces of screwing up and total steam pressure on face plate—$10,000 + 8,000 = 18,000$ lbs., from 250,000, we get 232,000 lbs. excess strength of stud bolts.

It is not reasonable to suppose that any pressure short of that required to elongate or fracture the stud bolts will lessen the screwing-up pressure. The tension on the stud bolts caused by the screwing-up strain is, therefore, constant, always tending to pull them apart or break them, whether live steam be in the cylinder or not. When steam at any pressure is admitted to the cylinder and comes in contact with the face plate or cover, the tensile strain on the stud bolts is increased proportionately, and is equal to the area of the face plate in square inch multiplied by the pressure per square inch. Now, the two forces as they affect the stud bolts act in the same direction, both causing a tensile strain outward, consequently they cannot balance each other, and, as there is nothing else to support this strain, the duty is fulfilled by the stud bolts, a conclusion about which there can be no doubt.

LEAKY STUFFING BOX REMEDY.

By J. E. McCormick.

ON an old engine, the governor spindle stuffing box had been turned to tightly fit into the hole drilled for it in the top of the governor valve chamber and had been thus forced into place, but after long service it had become so loose as to develop a disagreeable leak. I remedied the latter by cutting two grooves as indicated in the sketch. As a small ridge was formed on each side of each groove, it increased the diameter between these points, and by going lightly at first and frequently trying it in place, a snug fit was easily secured at both grooves and the part again forced into place. By fitting and finishing the



LEAKY STUFFING BOX REMEDY.

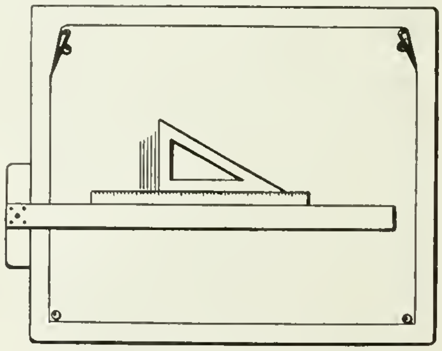
lower groove first, I was able to fit each groove independent of the other.

This repair was made three years ago, and although no lead or other substance was used, there has been no leaking since. I believe this method of "expanding" may be adapted to some other items of repair work where a tight fit is required in a joint requiring no movement between the parts.

SPACING LINES ACCURATELY.

By N. G. Near.

I SUBMIT herewith a little time-saving drafting kink that I have found useful many times. The drawing, I believe, makes the matter clear. I lay an



SPACING LINES ACCURATELY.

ordinary scale against the T-square as shown, and, from the graduations on the scale, draw my parallel lines with perfection and despatch. Inasmuch as there are many different kinds of scales in the world, carrying a multitude of graduations—English, metric, printers, tenths and hundredths of an inch, etc., it is evident that this scheme is quite universal of application; besides, the undesirable feature of pricking holes in the paper, often resorted to, is removed.

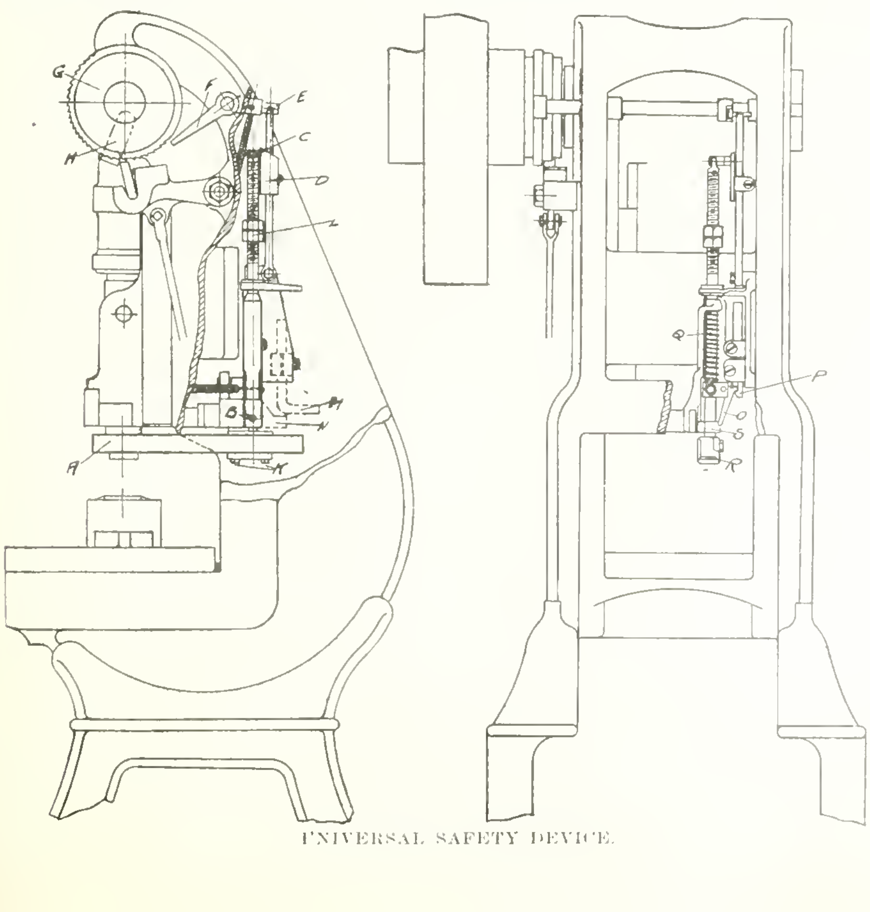
UNIVERSAL SAFETY DEVICE.

THE illustration shows power press equipped with a safety device for protecting the operator when feeding the work. The device consists primarily of a guard built round the punch and connected to the driving mechanism. The guard moves down ahead of the punch, and upon meeting any obstruction such as the operator's fingers, immediately stops the ram. In operation, the guard (A) which is connected to the ram is automatically released and travels in advance of the punch. Upon meeting an obstruction, the guard tilts the vertical rod pivoted at (B), and roller (C) comes in contact with bar (D) upon which pin (E) is resting. When (E) is released, the spring pulls pawl (F) down, which engages with the ratchet ring (G) and is driven by end of clutch pin (H). The ring being held causes the clutch to release and so immediately stops any further movement of the ram.

screwed firmly into position on the threaded nose (C), thus, the jig is brought into position for work.

The illustration shows the ram in the top position. When it travels down, it carries rod (S) with it, at the same time catch (O) is released by catch (P), permitting it to fall, accelerated by spring (Q) and moving the guard 1¼ inch in advance of the punch part of the way, after which they travel down together, the guard always in advance of the punch. The lock nuts (L) are adjusted so as to prevent the guard travelling too far and striking the die. On the return or upward motion, the ram carries rod (S) with it which engages with catch (O), pushing the rod up, the guard travelling with it. This arrangement is only fitted to long stroke presses. For short stroke presses an arrangement is shown by dotted lines in which projection (N) upon coming to the top of the stroke, strikes bracket (M) and presses down the back of the guard causing it to tilt in front. This arrangement prevents the guard from obstructing the operator when feeding the press and also allows the front of guard to fall at the beginning of the stroke and travel ahead of the punch. The guard in either type is adjustable length-ways by cap screws (K), and vertically by clamping device (R).

This Universal Safety Device has been patented in Canada, the United States, Great Britain and several foreign countries by the proprietors the Wright-Stacey Protection Co., Hamilton, Ont.

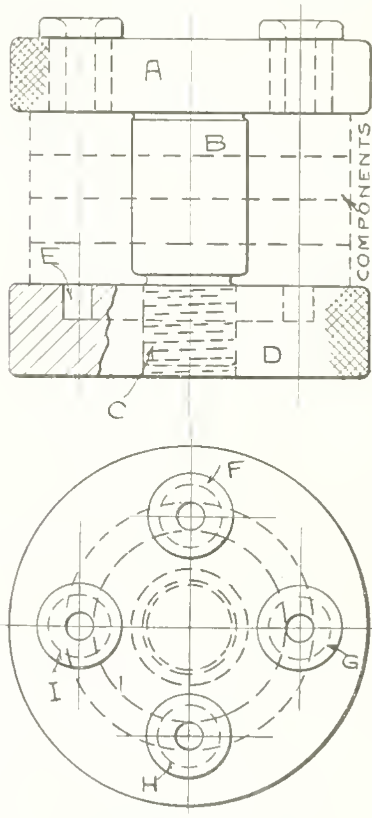


UNIVERSAL SAFETY DEVICE.

A USEFUL DRILLING JIG.

By W. G.

THE drilling jig herewith described is of very simple construction, and if properly made should turn out work



A USEFUL DRILLING JIG

of first class quality. The jig in question was used for drilling peg holes in a number of circular discs, 2¾ in. dia. by 3/16 in. thick. The holes in the said discs had to be interchangeable with each other, so that when one disc became worn it could be replaced by another. A glance at the accompanying drawing will no doubt give a clear idea of its general construction, the upper view being part sectional elevation, while the lower view represents the plan. The bush plate (A) is preferably made from a piece of good quality mild steel, and consists of a circular knurled disc having a reduced locating bung or stem part (B). It is further provided with a screwed end (C) for the purpose of securing it to the base (D); the latter consisting of a circular knurled mild steel disc having a central tapped hole for the purpose of securing it to the screwed nose (C) of the bush plate (A). It is also provided upon its inner face with a recess (E), the object of the latter being to provide clearance for the drill when in operation. The bushes (F), (G), (H), (I), should be made from best cast steel and carefully hardened and ground. The sequence of operation is as follows:—

The components (see dotted lines in upper figures are first passed on to the locating bung (B); the base (D) is next

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Attention is drawn to the accompanying course in arithmetic, a concurrent study of which is recommended with that of the Question and Answer Series.

Question.—Will you be good enough to supply the following information through your question and answer department. What is the prevailing general method and the formulae used in the process of galvanizing iron?—A. McK.

Answer.—There are three methods of galvanizing iron in general use at present, viz., hot galvanizing or the process of immersing the iron in a bath of molten zinc; the cold process or electro-galvanizing by means of the electric current and a suitable electrolyte; and the vapor method which consists of subjecting the articles to be treated to a vapor of zinc while revolving in a rotating enclosed chamber in a furnace. Each method has its peculiar use and advantages, and the results obtained are very satisfactory when the respective operation is properly attended to.

Certain fallacies existed for a long time as to relative merits of the different processes. The cold or electrolytic method was found to be too slow and costly, and the results were erratic and not satisfactory. As a consequence, the process was soon discarded for the hot method, but the difficulty of management in connection with large baths of molten zinc, the deterioration of the bath and other mechanical causes limited the process to articles of comparatively small size and weight. The electro zincing process on the other hand has been subject to many patents and there are now two companies on this continent who manufacture and install the mechanical equipment and solutions with which the most difficult casting or iron object may be satisfactory coated by the electrolytic method.

The hot or molten process consists of first removing the scale oxides and grease from the article to be treated, and the immersing the article dry in a bath of molten zinc varying in temperature from the melting point to 900 degrees Fah. according to the thickness of the coating desired and the nature of the work being treated. A high temperature produces thin coatings while low temperatures allow of thicker coverings. This method of regulation is unsatisfactory as at high temperatures more zinc combines with the iron to form dross and this must be removed frequently. For this reason it is customary to operate the bath at as low temperatures as possible and to remove the excess of zinc by jarring or by a shaking motion immediately upon removal from the molten metal.

The electrolytic method consists of suspending the article to be treated in a bath composed of 2½ pounds of zinc sulphate dissolved in 1 gallon of water, together with 1 ounce of sulphate of aluminum which is added by thorough stirring. The article forms the cathode and the thickness of the coating depends upon the length of time it is treated and the volume of current used. It is advisable to equip the bath with plenty of pure zinc anodes and to allow it to remain at rest for at least 12 hours after preparing same, thus freeing the solution of any excess of acid. The temperature of solution should be maintained uniform, and never below 45 degrees Fah. When deficient in metal, add more zinc sulphate, and when the deposit produced is dark colored, add more aluminum sulphate. Operate the solution with a tension of from 5 to 6 volts, and keep the bath at about 18 or 20 degrees Beaume. Use as strong current as possible without interfering with the adherent qualities of the deposit. If the coating has a tendency to flake at lower edges, reduce the flow of amperes. Usually from 15 to 75 amperes per square foot is sufficient range to cover the various classes of work. The latter is prepared in the same manner as for electro-plating with other metals and must be clean, with all trace of acids removed from the pores of the metal to be treated before entering the zincing solution. If such precautions are not taken, black spots will remain and spoil the finish. Boiling in strong lye is an effective method of removing the acid from the pores. Use a large anode surface and keep them clean, or otherwise the bath will become exhausted of metal and the solution be rendered acid.

A solution consisting of 2 pounds zinc sulphate, 2 ounces aluminum sulphate, ¼ ounce glycerine and 1 gallon of water is also in general use and produces a very smooth durable deposit. The many advantages of the electrical process as in use to-day make it especially commendable to the manufacturer. The consumption of zinc is less than by the molten method. Threaded parts are handled equally as easily as plain surfaces. The deposit withstands the most severe test, and the treatment is a pleasant operation which may be carried out in any plating room. The usual cause of failure is a depleted solution, and if this point is remembered there should be no difficulty in electro-zincing any article of cast, wrought or sheet iron of reasonable size or shape.

The vapor process is not in general use in this country being still in the experimental stages. In Europe it is regarded, however, as superior to the electro method and is being employed by several large concerns. No doubt it will eventually find its way into the industries of this continent, as the principle of the treatment is well founded. Thus far, the various processes of vaporizing iron are covered by patents.

* * *

Question.—Give a definition of the mechanism as expressed by the word **Turbine.**

Answer.—A turbine is a prime mover in which gradual changes in the momentum of a fluid are utilized to produce rotation of the moving members.

* * *

Question.—Explain the difference between a turbine as above described and a rotary engine.

Answer.—In order to fulfil the requirements embodied in the answer to the first question, the only method suitable in practice for communicating the fluid energy to the rotor parts is to occasion a change in the fluid velocity. It should, therefore, be noted that pressure plays no part in the operation. A rotary engine on the other hand depends for its action on pressure, and in consequence is a mechanism entirely distinct from the turbine.

* * *

Question.—What is understood by the **Load Factor** in an electrical installation?

Answer.—The load factor of an electrical power plant or any unit of it is the ratio of the average output to the maximum. Thus, if, in an electrical installation, M=the maximum kilowatt output, and K=the total output in N hours, then the load factor for that period is $\frac{K}{M \times N}$. As this is commonly expressed as a percentage, the load factor $= \frac{K \times 100}{M \times N}$. The period usually taken is one year, therefore the load factor=

$$\frac{\text{Total Units Generated} \times 100}{\text{Maximum Load} \times 24 \times 365}$$

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

GRIDLEY AUTOMATIC MULTIPLE SPINDLE DRILL.

THE Gridley Automatic Multiple Spindle Drilling Machine is in essence a vertical turret machine for drill-

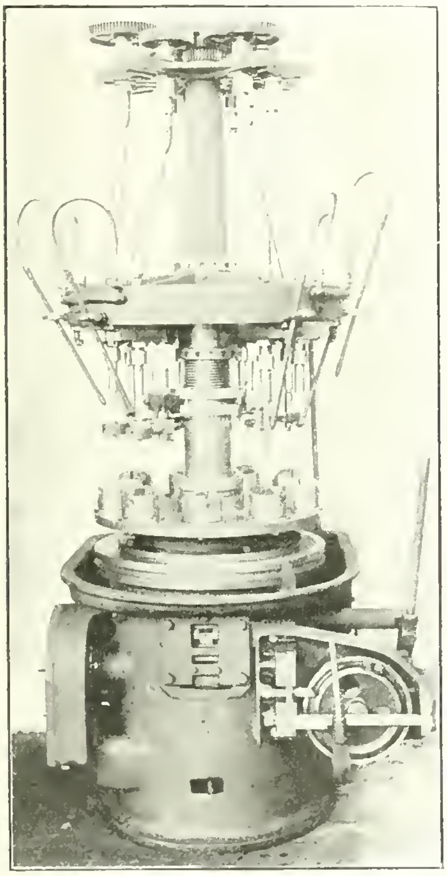


FIG. 1. GRIDLEY AUTOMATIC MULTIPLE SPINDLE DRILL.

ing, reaming, counterboring, and facing parts. Its radical features consist in the spindles being adjustable both radially and circumferentially, enabling the locating of all spindles at a common centre or at different points. Holes can be drilled cutting into each other or as far apart as the capacity of the machine will allow. The spindles are individually adjustable so that any tool may be placed in a position to act upon any point or to any depth regardless of the position of the other tools. As all of the spindles are supported from the centre column around an entire circle, the thrust on one side being balanced by the thrust on the opposite side, the centre column receives no undue strain and any spring due to heavy feeds is eliminated.

The work is held in chucks or suitable fixtures on a rotating work table which revolves around the centre column, and, as it is necessary to have one position at the table idle for the purpose of removing the finished piece and inserting a blank, one more chuck or fixture is used than there are spindles. In Fig. 3 it will be noticed that the blank has been placed in the fixture ready for indexing. The die in the fixture at the right is finished and will be removed when the table has advanced one point, bringing it into position at the loading space.

As many spindles can be built into the machine as may be required by the class of work to be operated upon, from five to nine being the usual number needed. In order to divide the time of the various operations into as nearly a uniform unit as possible, it is sometimes advisable to use two or more spindles working in the same hole, each doing its proportion of the whole depth.

The table indexes one point each time it is lowered from the tools, and one finished piece of work results each time the table moves upward. The time taken to produce the piece, as in the Gridley Automatic Multiple Spindle Screw Machine, is that of the longest operation plus the idle time required to bring the work to the tools in the next position. Each spindle can be geared to the right speed for the tool which it carries, and in cases where extra heavy service is required of one or more tools, special heavy spindles can be used for these operations. In drilling a layout of holes, to insure an accurate spacing between

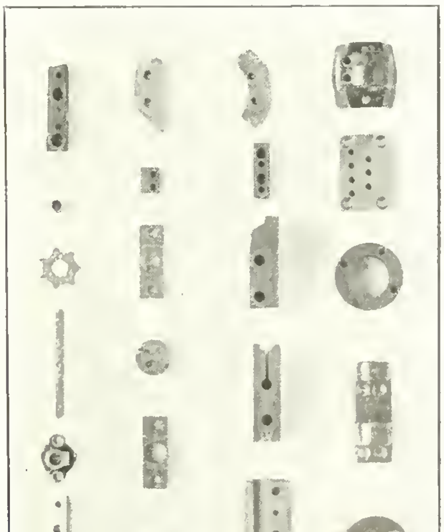


FIG. 4. WORK ADAPTED TO MULTIPLE SPINDLE DRILL.

them, two methods of holding drill bushings are used. When only a few drills or other tools need guide bushings, holders with adjustable vertical and horizontal arms are used. When a large

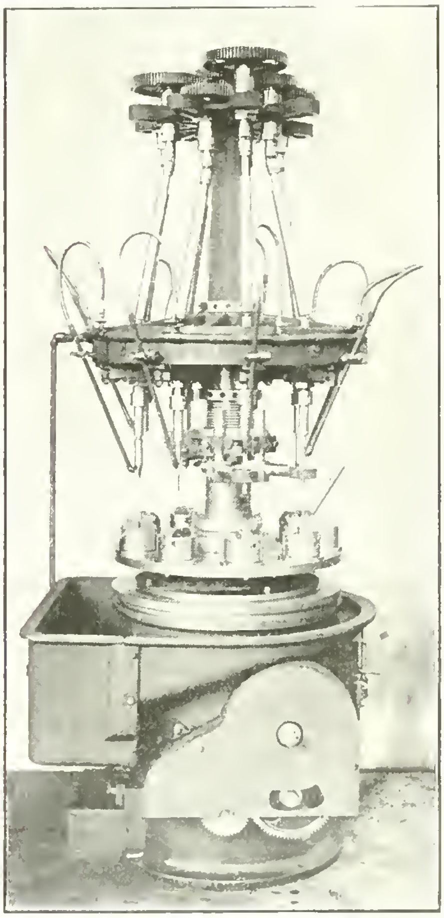


FIG. 2. GRIDLEY AUTOMATIC MULTIPLE SPINDLE DRILL.

number of holes are to be drilled, a plate is furnished extending around the centre column between the work carrying table and the spindles. In this plate are large holes, one in line with each spindle.

Over these holes are clamped small adjustable cast iron bushing holders which can be quickly set to the required position. In changing from one job to another only the bushing holders are changed, and on some classes of work it is necessary to change but one or two of these. For drills and some other tools, hardened steel bushings are used. On other tools with only short flutes, bronze bushings are furnished. These give no trouble at high speeds, and, besides locating the tools, prevent chattering.

There is little difficulty found in setting the machine for operation on

different pieces of work; the tools being inserted in their holders. A perfect sample of the exact size and finish of the piece to be made is placed in the chuck or fixture, and the table advanced by hand until the piece is located at the spot under the first spindle where the operation commences. The spindle is then swung into exact position, and the guide, either bushing holder or bracket, securely fastened. After raising the table to its highest cutting point, the spindle is adjusted vertically to secure the proper depth of the hole. This operation is repeated until each tool is properly located. Then, by referring to the table of spindle speeds, the proper gears are placed on the centre shaft and spindles and all brought into mesh. Located on the lower left-hand side of the machine are the change gears which give the different speeds to the vertical centre shaft. Also here are located the feed gears giving the different tool feeds to the table.

After the proper speed and feed gears are in position the table is brought up to the position where the first tool of the set to cut nearly touches the work. At this point a cam-pin on the operating disc is set to throw out the fast feed clutch. This allows the feed gears to drive the table at the proper tool feed. After the table has reached its highest point and the tools are through cutting, the second cam pin on the operating disc is set to throw in the fast feed clutch. The machine is then ready to start, and each time it indexes, a blank is inserted.

The machine is provided with gear-driven oil pump, oil tank, and separate oil supply with adjustable nozzle to each spindle. Ample drip room is provided with self-draining drip tank, strainer and room for removing chips without disturbing the oil guards. The Windsor Machine Co., Windsor, Vt., are the designers and builders of this machine.

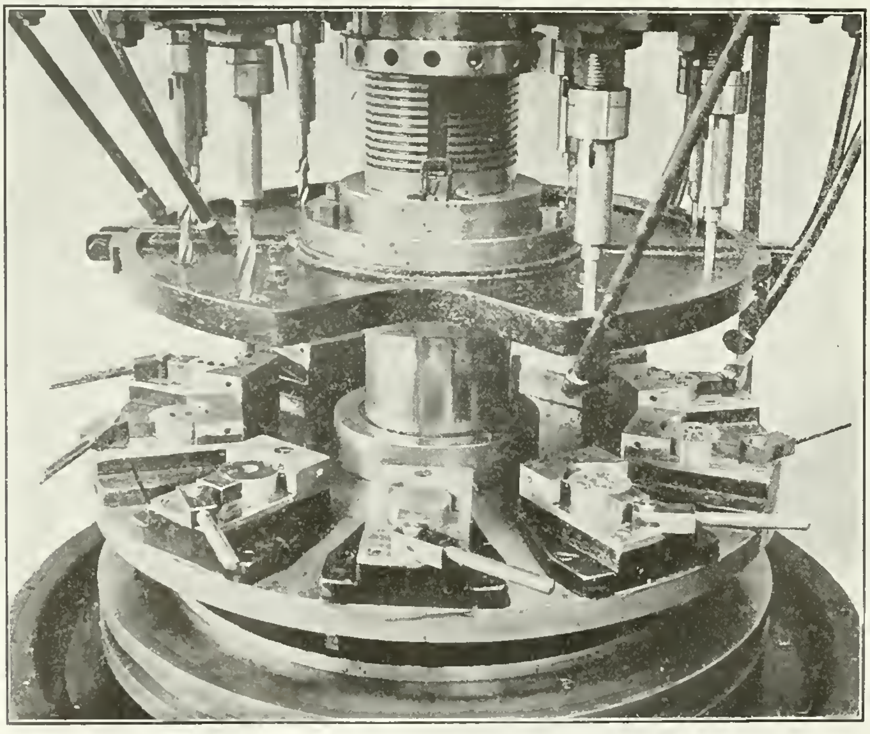


FIG. 3. GRIDLEY AUTOMATIC MULTIPLE SPINDLE DRILL.

THE LENNOX SERPENTINE SHEAR.

THE Lennox Serpentine Shear, a new type of machine now being offered by Joseph T. Ryerson & Son, Chicago, is designed particularly for the straight and irregular cutting of sheets and plates. The frame is a steel casting of spiral construction designed to provide sufficient clearance for material of unlimited length or width. This machine will handle not only straight cutting but also in or out curves having a minimum radius only slightly larger than the diameter of the blades. The spiral steel frame carries all gearing and is mounted on a substantial cast-iron base. All gears have teeth cut from solid metal and are provided with cast-iron gear guards so the workman is fully protected while operating the machine.

The blades which are made of high-grade tool steel, are set in approximately a horizontal plane. This gives a very large cutter bearing on the sheet or plate, and consequently there is very little distortion in the cutting. The upper cutter is positively driven, while the lower cutter is mounted in an adjustable sleeve, so that its position may be varied to allow for different thicknesses of material and for redressing. In addition to this, a cam is provided so that the lower blade can be dropped enough to permit the removal of sheets without reversing the machine. The cutters have a flush fastening to the shaft so that no nut projects to interfere with the handling of the work and the knurled edges feed the sheet automatically into the machine. A tool steel pin is provided to take up the end thrust on the lower cutter shaft. Where a number of sheets are to be cut to the same pattern, a template may be bolted to the work and this template followed by guiding against the top cutter.

LENNOX SERPENTINE SHEAR

The machine is driven by means of a two-speed pulley, giving slow speed for intricate curve cutting and high speed for straight work. The main drive shaft is extended and squared on one end so that a hand crank may be used if power is not available. This shear, it is claimed, will reduce cutting costs fully one-half, by replacing old style hand and power cutters.

The shear illustrated has a capacity for cutting No. 10 gauge material and lighter, while other sizes having capacities of No. 16 gauge, $\frac{1}{4}$ inch and $\frac{3}{8}$ inch material can be furnished. All machines are arranged for either belt and hand power or direct motor drive.

ASSOCIATION AND PERSONAL

A Weekly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Machinery Circles

E. H. Verner has just been appointed city engineer at Port Coquitlam, B.C.

J. Antonisen, C.E., has tendered his resignation to the Brandon Street Railway Co.

C. H. Topp has been appointed engineer for the municipality of Esquimalt, B.C.

George Kennedy, superintendent of the Massey-Harris Co., Toronto, plant, is seriously ill.

J. C. Dietrich, of Galt, will go to Welland to inquire into the industrial possibilities there.

E. R. Bingham, O.L.S., has been appointed corporation surveyor for the City of Port Arthur.

P. D. Yates, Toronto, has been appointed manager of the St. Catharines, Ont., Hydro-Electric Commission.

F. L. Buckley, general manager of the British-Canadian Lumber Corporation, left recently for Great Britain on a business trip.

R. E. Harris, president, Nova Scotia Steel and Coal Co., was in Montreal recently, as was also Thomas Cantley, general manager.

F. R. Newman, manager of the Canadian Fairbanks-Morse Co., Toronto, sailed from London, Eng., yesterday, where he has been on a holiday.

W. P. Hinton, general passenger agent of the G.T.P., has been appointed assistant traffic manager of the system, with headquarters at Winnipeg.

George D. Mackie, town engineer of Swift Current, Sask., has been appointed commissioner for Moose Jaw, Sask., at a salary of $4,000 per year.

I. G. Haekel, representing the Commercial Cars, Ltd., Luton, England, is in Vancouver looking for a suitable site for the erection of a motor truck factory.

W. L. Foster, Toronto, who is representing the Carbic, Ltd., of London, Eng., is sailing this week for the Old Country on a business trip and will be away about six weeks.

James DeVon, formerly specialist with the Taylor Instrument Co., Rochester, N.Y., has been appointed Canadian representative for the Tbwing Instrument Co., Philadelphia, Pa., with office in Toronto.

M. J. Butler, of Armstrong-Whitworth of Canada, Ltd., left Montreal, February 19, on a visit to the works of the parent company in England. He expects to be back in Canada about the latter part of March.

F. Ditchfield has resigned his position as general superintendent of the Canadian Car and Foundry Co., Ltd., in order to become associated with the Mechanical Engineering Company, Ltd., Montreal.

Hon. Frank Cochrane, Minister of Railways, Ottawa, leaves on Thursday for a two months' trip to Great Britain and the Continent in the interest of his health. He will be accompanied by Mrs. Cochrane.

WHO'S WHO.

A. H. JEFFREY,
Manager and Secretary, Polson Iron Works, Ltd., Toronto.

Goodwin Shenton has been appointed manager of the Winnipeg, Vancouver and Victoria branches of John Millen & Son, Montreal. Mr. Shenton is a native of Winchester, England. Coming to Canada in 1911, he joined the railway supply department of John Millen & Son, latterly acting as assistant to Mr. F. D. Lyman, the manager of the department.

George Albert Kieffer, of Kieffer Bros., machinists, Montreal, died on Monday, Feb. 8, after three weeks' illness.

John Coates, the founder and chairman of the engineering firm of John Coates, Limited, of Westminster, died in London, England, at the residence of his daughter. The deceased had recently returned from Ottawa, his advice having been sought in connection with the municipal plant there. He lived in Ottawa for sixteen years, where he played a prominent part in political and social life.

J. Frater Taylor, president of the Lake Superior Corporation, speaking on the subject of a fifty-cent per ton bounty on iron ore recently, before the members of the Sault Ste. Marie Board of Trade, criticized the statement made in a resolution sent by the Fort William Board of Trade to Toronto, in which it was said that there is a great deal of iron ore unnecessarily being imported into Canada from the United States. "You can rest assured," Mr. Taylor said, "that if we had the raw material at our back and could get it as cheaply as we can get it in the United States we would not be importing it. The Algoma Steel Corporation is at present importing 600,000 tons yearly, and with the installation of a fourth blast furnace which will take place in the near future one million tons will be required."

Railway Club Banquet.—The Central Railway and Engineering Club of Canada celebrated its eighth anniversary by a banquet on Monday evening, Feb. 23, at the Grand Union Hotel, which was attended by over two hundred members and guests. Mr. Thomas was toastmaster. After the toast to "The King" the following toasts were honored: "The Empire," by W. R. McRae and C. A. Jefferis; "The Central Railway and Engineering Club," by G. Baldwin, R. Patterson and A. M. Wickens. Among the guests present were: W. McIntosh and G. E. McIntosh, Stratford; C. R. Curry, Brockville; J. F. Franey, A. W. Crouch and J. B. Wilson, Toronto.

The Independent Pneumatic Tool Co., Chicago, Ill., are distributing circular "U," just off the press, which describes and illustrates the "Thor" roller-bearing piston air drills, grinders, chipping and riveting hammers, and electric drills, etc. Individual illustrations are given for each size, and a table is included giving general specification and capacity of all types and of each size. Copies will be gladly sent to interested readers.

INDUSTRIAL NOTABILITIES--No. 23

IT would probably be difficult to find a man better known to the heads of the mechanical world in Canada, or one more popular among those with whom business or pleasure brings him in contact, than J. P. McNaughton, the general sales manager of the Dominion Iron & Steel Company.

James Percy McNaughton was born May 8th, 1867, at Ottawa, his parents being Malcolm McNaughton and Maria (Ogilvie) McNaughton, both natives of Montreal. He received his education in the public schools of Ottawa and at the Ottawa Collegiate Institute. His initiation into the world of business took place in the year 1885, when he entered the wholesale warehouse of McIntyre, Son & Co., Montreal. He remained with this firm for three years, and then went to Drummond, McCall & Co., Montreal, since when his connection with the steel and iron business has been continuous.

After holding various responsible positions with Drummond, McCall & Co. for nine years, Mr. McNaughton left to form the firm of Lamplough & McNaughton, who

JAMES PERCY McNAUGHTON.

engaged in the metal brokerage business. In 1903 he was approached by the Dominion Iron & Steel Company and accepted a position as their Montreal sales agent. Two years later he received the appointment of General Sales Agent, which important post he still holds.

The Dominion Iron & Steel Company is the largest steel concern in Canada, and employs a small army of men in its various departments. Mr. McNaughton is therefore kept extremely busy, and has no time for hobbies nor yet for political offices. While he has had several very good opportunities of holding high civic positions, he prefers to devote his whole time to the business interests of his firm.

Mr. McNaughton is a member of the Royal Cape Breton Yacht Club; the Engineers' Club, Montreal; and is a life member of the Montreal Amateur Athletic Association.

He was married April 26th, 1911, to Etta May Peirce Peppett, of North Sydney, and has one son, born May 13th, 1912.

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Vol. XI. FEBRUARY 26, 1914 No. 9

PRINCIPAL CONTENTS.

THE FAILURES AS WELL AS THE SUCCESSES.

It is a well established fact that, whether as individuals, as a community or a nation, we not only are prone to, but quite deliberately and systematically cultivate and practise the suppression of our every failure in no matter what sphere or department such may have been our experience. The question has been repeatedly asked—Should engineers publish details of their failures as well as of their successes? and except on the ground of personal susceptibility and its probable effect on their future social and professional standing, there are no other reasons in sight to make the answer to the query other than in the affirmative. Of course, what is applicable to the engineering profession applies with equal force to every craft and calling, and need we point out that failure, as well as success is the legacy of every human, entering as they do into every nook and cranny of our complex being.

Aside, however, from the foregoing, or, as we might dub it, the sentimental feature, there is more or less weakness apparent in this universally practised shrinking from making our failures public, yet it must be admitted that the attitude adopted in screening our failures is not altogether without beneficial results. We, perhaps, glorify success to an undue extent in every walk of life, and, did we otherwise, much of what we now call failure might well merit the higher title. Success and failure are in many cases twin events, neither being at any time far removed from the other; a failure of success and a success from failure being a daily occurrence.

All of our boasted twentieth century advancement, progress, and achievement are the results of success from failure and disappointment, even to the extent of despair, and when we are disposed to mope over the non-accomplishment of some cherished ideal or find the stress of competition bearing hard, it should be remembered that if we cannot rise to success from what to us seems nothing but a wreck, another will, and that, of course, as a result of what our failure has shown him. All of us add our little quota to the general forward movement in affairs individual, social, commercial, business, political, national, and religious, and we need not worry overmuch if sometimes we sow and another reaps.

In the business world, individuals, companies, and corporations are victims of the up and down process which we define as success and failure, and it is well perhaps that life is so constituted. The trouble, however, is that the down process usually appeals to and points the direction in vain for the cure, with the consequence that those affected look to everything and everybody else but themselves for a cause and a culprit of their misfortune.

All manufacturing concerns have not an equal rating in the matter of machine type, quality or quantity output; a condition easily realized because each individual being in or out of their employ has a rating peculiar to himself and consequently bears a comparative relationship to his fellow. Forms and application of products vary in successful adaptation from a variety of causes, avoidable and otherwise, and may in many instances never adequately bring success in their train, but if the latter be possible of achievement, and this be sincerely desired, then, besides the blazoning of the failure abroad, the contributory causes pertaining thereto should be made fully known in addition, so that not only those directly interested, but others whose work lies along kindred lines may either join hands in the remedy or build and operate better than the original craftsman.

Might we suggest to contributors to Canadian Machinery, that records of failure are stepping-stones to success, but the contributory facts must of necessity be full and complete, otherwise when superficial statements are made, the effects are destructive, and may unwittingly be the means of "knocking," or its equivalent—kicking a man when he is down.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3....	19 50	20 00
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3.......	19 50	20 00
Clarence, No. 3........	19 50	20 00
Jarrow	.....	23 50
Glengarnock	......	26 00
Summerlee, No. 3......	22 00	.....
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1........	19 40	18 35
Victoria, No. 2X	19 15	18 10
Victoria No. 2 Plain ..	18 90	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh.........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal......	2.10
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh.....	1.20
Steel hoops, Pittsburgh..........	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, 5/8 diam., 100 lbs.		2 85

BOILER PLATES.

	Montreal.	Toronto.
Plates, 1/4 in., 100 lbs...	$2 30	$2 20
Heads, per 100 lbs.......	2 55	2 55
Tank plates, 3-16 in......	2 60	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1 1/4 in.	9 50	9 00
" " 1 1/2 "	9 50	9 00
" " 1 3/4 "	9 50	9 00
" " 2 "	9 00	8 75
" " 2 1/2 "	11 15	11 50
" " 3 "	12 10	12 50
" " 3 1/2 "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7 1/2
Coach and lag screws....	75
Plate Washers	45
Machine bolts, 3/8 and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4 1/4 per lb off
Nuts, Hexagon, all sizes..	4 1/2 per lb off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright ... .85, 10, 7 1/2, 10 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7 1/2, 10 p.c. off	
Wood screws, flathead, bronze ... .70, 10, 7 1/2, 10 p.c. off	

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in...	75%
Finished Nuts over 1 in....	72%
Semi-Fin. Nuts up to 1 in..	72%
Semi-Fin. Nuts over 1 in...	72%
Studs....................	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 00	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings..	9 00	9 00
No. 1 wrought iron.....	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	13 00	12 00
New brass clippings....	8 50	8 75
No. 1 brass turnings....	7 25	7 50
Heavy lead	3 75	4 00
Tea lead	3 00	3 00
Scrap zinc	3 00	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
1/8 in	$ .05 1/2	1/8 in	$ .12	1/2	$. 32
1/4 in	.06	1/4 in	.07 1/2	3/4	.35
3/8 in	.06	3/8 in	.07 1/2	1	.37
1/2 in	.08 1/2	1/2 in	.11	1 1/4	.52 1/2
3/4 in	.11 1/2	3/4 in	.15	1 1/2	.65
1 in	.17 1/2	1 in	.22	2	.91
1 1/4 in	.23 1/2	1 1/2 in	.30	2 1/2	1.37
1 1/2 in	.27 1/2	1 1/2 in	.36 1/2	3	1.86
2 in	.37	2 in	.50 1/2	3 1/2	2.30
2 1/2 in	.58 1/2	2 1/2 in	.77	4	2.76
3 in	.76 1/2	3 in	1.03	4 1/2	3.26
3 1/2 in	.92	3 1/2 in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4 1/2 in	1.27	4 1/2 in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	.....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
1/4, 3/8 in.	64	49	....	....
1/2 in.	69	58	....	....
3/4 to 2 in. ...	73 1/2	63 1/2	....	....
2 in.	....	....	69 1/2	59 1/2
2 1/2 to 4 in....	73	63	72	62
4 1/2 to 6 in. ..	....	....	73	63
7, 8, 10 in. ..	....	....	67 1/2	56 1/2
X Strong P. E.				
1/4, 3/8 in	56 1/2	46 1/2	....	....
1/2 in.	64	54	....	....
3/4 to 1 1/2 in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2 1/2 to 4 in. ...	....	....	66	56
4 1/2 to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
1/2 to 2 in.	43	33	....	....
2 1/2 to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto
Lake copper, carload....	$16 00	$15 75
Electrolytic copper	15 75	15 25
Casting copper	15 00	15 00
Spelter	5 25	5 25
Tin	42 00	42 00
Lead	5 15	5 30
Antimony	8 50	8 50
Aluminum	21 00	19 00

SHEETS.

	Montreal.	Toronto.
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4.30	4.10
Queen's Head, 28 B.W.G.	4.40	4.20
Fleur-de-Lis, B.W.G.	4.20	4.20
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.40	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal.	0.22
Pure turpentine	0.69
Linseed oil, raw	0.60
Linseed oil, boiled	0.63
Plaster of Paris, per bbl	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., Feb. 23, 1914.—No new developments have taken place in business circles, but in most lines trade continues to show an improvement. There is a very fair demand for boiler and tank plates and also for boiler tubes. Prices are very firm and an advance may be looked for shortly. In bar iron and steel, on the other hand, business is not quite so brisk, and no great improvement in the steel situation is looked for until the building trade picks up again.

Disappointment is felt in machine tool circles at the announcement that the Grand Trunk Railway do not at present contemplate rebuilding the shops destroyed by fire recently at Port Huron. Dealers had been hoping that a nice order for new equipment would be placed for these shops. Mussens, Ltd., report having closed an order for the complete machine shop equipment required by Balby, Yerburgh & Hutchison in connection with their contract on Section No. 3 of the new Welland Canal.

The Metal Market.

In the metal market business still remains quiet. There is a small demand for pig iron, but other metals are distinctly dull. Copper is a shade easier than last week, but there is no improvement in the demand and the market is almost at a standstill. Present indications point to continued easy prices for this metal.

The spelter market is also undoubtedly dull, but the large producers are showing no inclination to force business, being mostly well supplied with contracts.

The tin situation shows signs of becoming more settled and there has been some heavy buying by dealers during the past week or two. The price has fallen locally to $42, a drop of $1 from last week, and it is probable that a period of dullness may follow the present activity.

Toronto, Ont., Feb. 24, 1914.—The principal feature to record this week is the annual automobile show held in the Canadian National Exhibition Buildings. The attendance and sales exceeded those of last year, which would seem to indicate that the coming season promises to be a satisfactory one for automobile manufacturers. Not the least interesting feature was the success of the motor truck manufacturers, it being reported that orders for over 100 trucks, heavy and light models, were booked. This is a big advance over last year's show, and indicates the large place which motor trucks are taking in industrial circles. Further reference to the truck feature is made in another section of our columns.

The market generally is quiet, no movements of any moment having been recorded during the week. Prices in structural steel remain firm, and little increase in the volume of business can be expected until building operations become more active. The continued cold weather is to a large extent responsible for the cessation of building operations, and that condition, combined with the financial stringency, directly affects the structural steel market. With moderating weather and advancement of the season business will, no doubt, improve. One firm reports that some nice specifications for reinforcement bars are in sight, and that business with them is pretty fair.

In the smaller lines, such as tool steel and machine shop supplies, business continues quiet, and will remain so until trade generally becomes more active. Reports from Ontario indicate that few large orders are being placed; those secured being principally for immediate requirements.

The machine tool market remains inactive, and no improvement can be reported over last week. One local firm sold a Pratt & Whitney die sinker to the Dominion Stamping Co., Walkerville, who are equipping a plant there for making automobile windshields. They may be requiring more tools later. The C.P.R. have sent out a specification for radial drills for the Angus shops, Montreal.

Municipalities are beginning to consider their requirements for the coming season, and already a few specifications for cast iron pipe have been issued.

The weakness in the metal market reported last week still continues, both tin and lead having suffered a slight drop, the former being quoted at $42 and the latter at $5.30. Other prices remain stationary.

Sir Thomas Skinner has been appointed governor of the Hudson's Bay Co., in succession to the late Lord Strathcona.

Machinists' Ball at St. Thomas, Ont.—The fourth annual ball of St. Thomas Lodge, No. 294, International Association of Machinists, was held in the Engineers' Auditorium, on Monday evening, February 23rd. The committee in charge made every effort and succeeded in making this the social event of the season. Many out-of-town visitors, including the officers of the Grand Lodge, were present. Alfred Dunn's orchestra of twelve pieces rendered the following programme:—"Sailing Down Chesapeake Bay," "Come to the Ball," "Carolina Rag," "Golden Dreams," "Salvation Nell," "When I Fell in Love With You," "Trail of the Lonesome Pine," "Just a Dream of You, Dear," "Get Out and Get Under," "A Thousand Kisses," "Skeleton Rag," "Old Wedding Gown," "Kill That Bear," "You're My Sweetheart," "Big Red Motor," "Charme D'Amour," "Silvery Bells," "I Love You, Dear," "My Hero," "Porissinio," "Isle D'Amour," "A La Militaire," "I'm Falling in Love With Some One," A buffet lunch was provided by Taylor & Bond. The committee in charge were T. W. Stone, chairman; H. A. Vicary, secretary-treasurer; J. H. Gray, J. Lane, C. J. Rowley, A. Buchan, G. Richardson, J. W. S. Boath, L. W. Loney.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Bridgeburg, Ont.—The Grand Trunk Railway are extending their yard system, and will build coal chutes and a sand-drying building.

Regina, Sask.—It is announced that two important industries may locate here. They consist of a flax mill and a hat factory.

Ottawa, Ont.—A deputation representing Montreal financial interests recently waited on Premier Borden, asking for a $15,000,000 bond guarantee for a tunnel under the St. Lawrence.

Guelph, Ont.—The Standard Fitting and Valve Company's building and plant have been sold to a Cleveland firm manufacturing carbon steel products, who are establishing a Canadian branch.

Ottawa, Ont.—The foundry owned by the Alie Brothers, at Maniwaki, was completely destroyed by fire a few days ago. The loss is estimated at about four thousand dollars. There is no insurance.

Sarnia, Ont.—It has been decided to go ahead with the construction of the new coal dock at Point Edward to replace the one recently destroyed by fire. It is probable that the new dock will be built of steel.

Alliston, Ont.—The Dominion Gas Tractor Co. have decided to equip a plant for manufacturing gas traction engines. An existing building will be equipped with the necessary machinery and a foundry built later.

Ottawa, Ont.—Tenders are being called by the National Transcontinental Railway Commissioners for a "shavings and sawdust exhaust system" for the car shops at Transcona, Man. W. J. Press, mechanical engineer, Ottawa.

Galt, Ont.—The Union Metal Manufacturing Co., of Canton, O., are building a one-storey brick factory near the C.P.R. tracks, and will manufacture metal lighting and verandah columns, pressed steel tables and interior metal decorations.

Guelph, Ont.—The last engine in the old power house has been sold to Christie Bros., of Owen Sound. This was the last piece of machinery left of the civic plant, all of it being put out of use by the introduction of Hydro-Electric power.

Kerrobert, Sask.—Another new concern to locate in Kerrobert within the past few days is the Farmers' Machine Co., of Melville. Mr. Helgerson, the manager, is in town, and has made arrangements for the erection of a building 100 x 150 on the Board of Trade property, Railway Avenue West.

Electrical

St. Mary's.—A number of Nissouri farmers have made application to the Hydro-Electric Commission for power and light.

Windsor, Ont.—Niagara power will be here by June. The towers are in place to Chatham and tower foundations are completed.

Ayr, Ont.—The council here instructed the clerk to write the Hydro Commission and notify them that the town was ready to sign the contract for 100 horsepower.

Clinton, Ont.—The town is now using Hydro power and is supplying the Solo Player Piano Co., the Clinton News-Record and Doherty Piano Co., with power.

Strathroy, Ont.—The Hydro-Electric by-law carried here Monday with a sweeping majority of 102. Also the loan to the Canadian Handle Co. carried by a majority of 386.

Winnipeg, Man.—It is announced that the Winnipeg Electric Railway will undertake extensive hydro-electric developments. Plans are being prepared by the J. G. White Corporation, New York.

Woodbridge, Ont.—Woodbridge Council have decided to negotiate with the Hydro Electric Commission for supply of power for the municipality. An agreement was framed giving the current to the village at $38.50 per h.p.

Huntsville, Ont.—At a conference held between the Huntsville Council and members of the Bracebridge Electric Light Commission the question of purchasing power from Bracebridge was discussed, but it was thought that the Bracebridge Commission had no legal authority to sell electric power.

Municipal

Regina, Sask.—The city council propose to spend $170,000 on sewers.

St. Thomas, Ont.—The council are considering the purchase of steel garbage wagons.

Sarnia, Ont.—The council are considering the question of garbage disposal and may purchase an incinerator.

Regina, Sask.—Estimates passed recently by the city council include $10,000 for sewage disposal works.

Edmonton, Alta.—The city council have decided to install a sewage disposal plant. $53,000 has been appropriated for the work.

Toronto, Ont.—The city council contemplate buying four auto fire trucks and have appropriated $24,000 for this purpose.

Kingston, Ont.—The council has decided to buy 28 acres of land at Kingston Junction for manufacturing sites, at a cost of $24,000.

Regina, Sask.—A filter bed will be included in the proposed sewage disposal scheme. $35,000 has been included in the estimates for this work.

Plattsville, Ont.—A Hydro-Electric by-law was recently passed and the village council will require poles, wire, meters, etc. R. McKie, secretary.

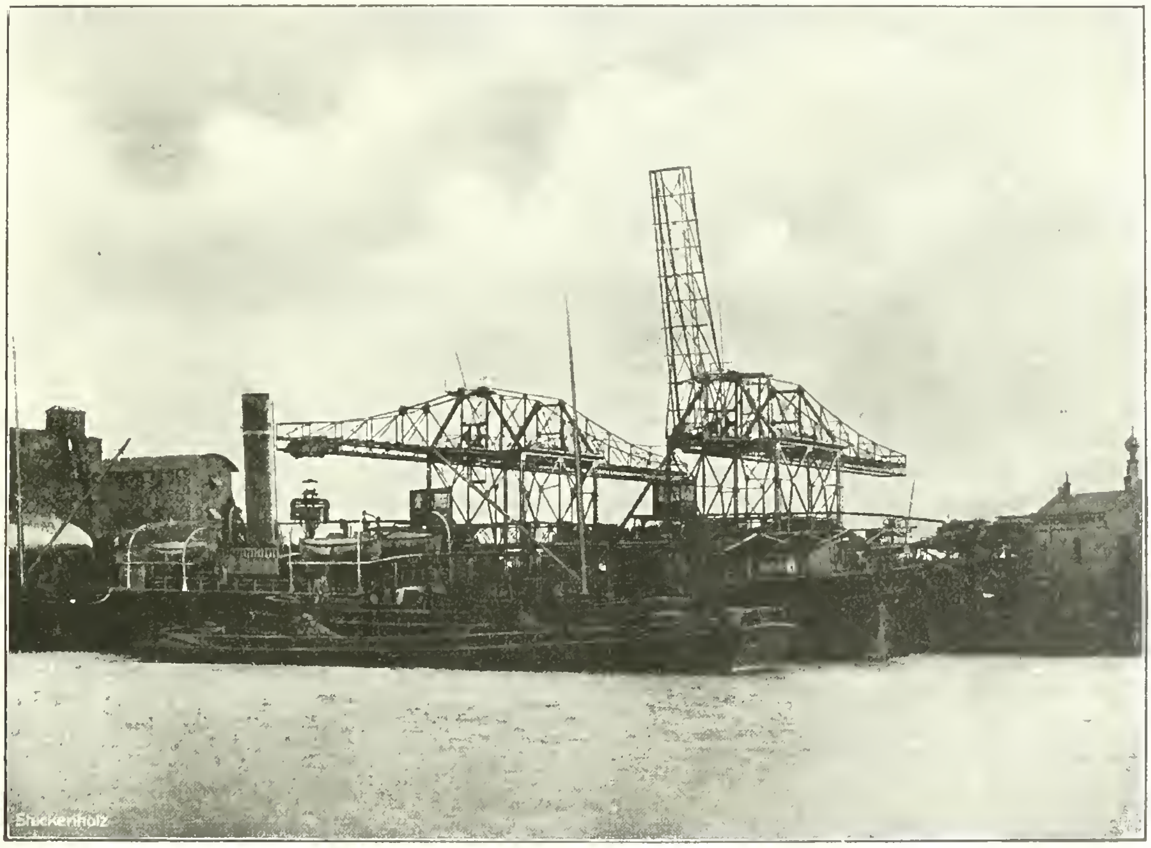
Kindersley, Sask.—The town are considering the purchase of a motor-driven pump for a proposed waterworks system. No details available at present.

Gloucester, Ont.—The council for Gloucester township contemplate installing a drainage system. Sidwell & Magwood are the engineers in charge of the scheme.

Ottawa, Ont.—The city council have decided to ask the Provincial Legislature for authority to raise $100,000 for the erection and equipment of a municipal abattoir.

New Liskeard, Ont.—The council have decided to purchase a fire truck and hose. A reservoir will probably be constructed and a water pressure recording gauge purchased.

Calgary, Alta.—The city commissioners have decided upon a comprehensive plan of electric extensions, and wil



agreements with the Conley Frog and Switch Co., the Davidson & Smith Co. and the new wagon works.

Saskatoon, Sask.—Tenders will be received until March 10 for the supply of 90 tons of cast iron pipe and specials and nine gate valves. Junius Johnson, city engineer.

Montreal, Que.—The city are calling tenders for automobile fire trucks and other apparatus. Tenders to be in by March 26, 1914. L. N. Senecal, secretary, Board of Commission.

Winnipeg, Man.—Tenders will be received by the chairman, Board of Control, up to March 2 for the supply and delivery of 24,000 feet of 36-in. steel pipe and specials. M. Peterson, secretary.

Peterborough, Ont.—Plans are practically completed for the new sewage disposal system to cost $100,000. They will be submitted to the Provincial Board of Health and if approved of, tenders will be called.

Montreal, Que.—The city engineer has presented a report to the Board of Control recommending the expenditure of $12,000,000 for increased transportation facilities. Two subways, an auto bus system and new surface lines in outlying districts are suggested as being necessary to relieve the present congestion.

Galt, Ont.—A representative of the Great Northern Electric Co. was here, negotiating with the council for the installation of 56 electric fire alarm boxes at a cost of $13,000. The council has decided to install the system and only the details remain to close the deal. The present fire brigade, 13 strong, will be increased to 20. New hose will be bought and the whole department overhauled and better equipped.

Refrigeration

Steveston, B.C.—The Columbia Cold Storage Co., will erect a new cold storage plant this spring.

Windsor, Ont.—The Windsor Ice Storage Co. have awarded a contract to the Canadian Ice Machine Co., Toronto, for refrigerating equipment.

Collingwood, Ont. — The Collingwood Fish & Ice Co. will erect an artificial ice plant and packing warehouse in the spring.

Toronto, Ont.—Permission will be asked from the Legislature by the city for power to spend $45,000 to install a cold storage plant in the new municipal abattoir.

Prince Rupert, B.C.—A site of 240 acres has been secured at Porpoise Harbor by B.C. Fisheries, Ltd., Vancouver, for the erection of an ice and cold storage plant.

Sidney, N.S.—R. Christie, of this city is interested in a company who will establish a cold storage plant here. It is expected that the erection of the buildings will be commenced in the spring.

Vancouver, B.C.—The contract for the foundation of the cold storage warehouse for the Vancouver-Prince Rupert Meat Co., has been awarded to E. J. Ryan, 568 Granville St. Separate tenders have been invited for cold storage equipment.

Medicine Hat, Alta.—Nelson Spencer, M.L.A., has proposed to the city council that he build a cold storage plant as an aid to the campaign to encourage mixed farming in the vicinity and to help the market. He will build the plant on a site selected by the city.

Contracts Awarded

Kingston, Ont.—The Standard Meter Co., of Toronto, was awarded the contract at $1,640 for 265 meters.

Victoria, B.C.—A contract has been let to Angus McDonnell & Co. for the development of the outer harbor. The contract involves over $2,250,000.

Brockville, Ont.—The contract was awarded to the Babcock & Wilcox Co. by the Brockville council for two boilers of 314 horsepower each, fitted with Detroit stokers and boilers to carry 200 lbs. pressure and 125 degrees superheat.

Ottawa, Ont. — The contract was awarded by the Dominion Government to the Manitoba Bridge and Iron Works, Ltd., of Winnipeg, Man., for the manufacture of 15,000 small and 500 large iron posts to be delivered at Edmonton, Alberta.

Winnipeg, Man.—It was finally decided by the city council to give the American Cast Iron Pipe Co, Birmingham, Alabama, the contract for the supply of 1,000 tons of steel pipe, in preference to the Canadian Iron Corpation at Fort William.

Windsor, Ont.—The following subcontracts have been let in connection with the Remington Arms Co. factory. General contractors, Wells & Gray, Manning House Block; metal work and plumbing, Pennington & Brian, 47 Sandwich St. W.; electrical work, Dominion Electric Co., 4 Pitt St. W.

Sydney, N.S. — The contract for the supply of 11,000 feet of cast iron piping has been let by the city council to the Canada Iron Corporation of Londonderry, N.S. The tenders for the supply of the centrifugal pumping plant were left over for the city engineer to examine the estimates and report to a later meeting.

General Industrial

Embrun, Ont.—The Williams Chemical Co., is building an addition to its plant.

New Liskeard, Ont.—Sam Eplett, of Coldwater, is proposing to build a large ice cream factory.

Windsor, Ont.—The Canadian Lamp & Stamping Co., will erect a one-storey addition to their factory.

London, Ont.—A firm of American tobacco manufacturers are negotiating for a site on which to build a factory.

London, Ont.—The London Pressed Brick Co. will probably build a brick plant at Regina, Sask. Edward Wright is manager.

Wiarton, Ont.—The council will be asked to grant a loan to a local company of $20,000 for the purpose of erecting a casket factory.

Lewiston, N.S.—J. Lewis & Son's factory, which was recently destroyed by fire will be rebuilt and equipped with new machinery.

Tillsonburg, Ont.—J. Austin McGlennon, of the Trent Valley Canners Co., Trenton, will probably establish a canning factory here.

Calgary, Alta.—It is reported that a large automobile factory will be built here. The company is reputed to have a capital of $250,000.

Regina, Sask.—The Canadian Equipment & Supply Co., of Calgary, have opened a new warehouse and office here. F. O'Neil is the local manager.

Petrolea, Ont.—The Canadian Oil Refinery Co. will build a factory for making wax, for which equipment will be required. The cost is estimated at $20,000.

Leduc, Alta.—A. Kuhn and J. Albert are contemplating the erection of a flour mill to have a capacity of 75 barrels per day. It will probably be in operation this fall.

Guelph, Ont.—The Guelph Spring and Axle Co. will in the near future put an addition to their plant, and will then be able to find employment for an additional 15 or 20 hands.

Toronto, Ont.—The plant of the James Purviss Mattress Mfg. Co., 2 Esplanade street, was damaged to the extent of $10,000 by fire recently. The loss is partly covered by insurance.

The advertiser would like to know where you saw his advertisement—tell him.

Walkerville, Ont.—The Willys-Overland Car Co., are looking for a site on which to build a factory. It is considered probable that they will locate here.

Vegreville, Alta.—Natural gas fields are being developed here and an effort will be made to induce manufacturers to establish industries.

Sudbury, Ont.—The Ontario and Manitoba Flour Mills have closed down the plant for a few weeks in order to make necessary repairs to the machinery.

Windsor, Ont.—Maul & Biggs, Ltd., are negotiating with the Industrial Committee for a site in the No. 1 factory district, where they will install a plant for manufacturing artificial stone.

Calgary, Alta.—The Mowbray-Berkeley interests, representing a large group of British capitalists, are arranging to sink their first test well near the western boundry of the Sarcee Indian reserve.

Cardston, Alta.—The Chief Canning Co. has been incorporated with a capital of $100,000. A site has been selected and a pea-canning factory will be built. Dr. Weeks, of Calgary, is interested.

Redcliff, Alta.—A knitting factory will be built here. It is estimated that the cost of buildings and machinery will be about $40,000. Dr. Bonnar represents the syndicate who are financing the project.

Toronto, Ont.—The old tannery of Wickett and Craig, at the corner of Cypress Street and Don Esplanade, was damaged to the extent of $1,500 by fire a few days ago.

Welland, Ont.—A charter has been granted the Ontario Tire & Rubber Co., Ltd., of Welland, the capital stock of which is $750,000. It is intended to carry on a co-operative tire manufacturing business here.

Guelph, Ont.—Libby, McNeil & Libby, food products manufacturers, advise that the equipment of their Toronto plant is being moved to Guelph, and that meantime no new machinery is contemplated.

Sarnia, Ont.—The coal hoist at Point Edward Grand Trunk dock, the property of the Northern Navigation Co., caught fire recently and was almost totally destroyed, entailing a loss of something like $40,000.

Sarnia, Ont.—It is understood that the Nye Odorless Crematory Co., of Atlanta, Georgia, is considering the building of a manufacturing plant in this city in the near future. This company is very well known in the States as manufacturers of incinerators, have purchased a plant for the special manufacture of smallwares which is to be added to the plant here and will furnish employment to a number of hands.

New Westminster, B C.—Eight thousand dollars damage was done at a fire

Beaverton, Ont.—Minorgan & Sons, of the Phoenix Foundry, are preparing to extend their present premises. The firm which broke out in the warehouse of the Milne Produce Co., Hamilton street, in the new wholesale district. The damage was chiefly to machinery and stock. One butter-making machine valued at $1,000 was destroyed.

Calgary, Alta.—A contract has been let at Olds, Alta., for the immediate drilling of eleven wells in the oil fields discovered in that locality. This is believed to be the largest contract for well drilling ever made in Canada at one time. The minimum expediture under the contract will be $150,000.

Petrolea, Ont.—Fire completely destroyed the Petrolea Motor Company's plant a few days ago, and caused the loss of thirty to forty automobiles and motor trucks, which were either stored in the building or in the process of construction. The monetary loss is not known, but will be very heavy.

Smithers, B.C.—Extensive deposits of iron ore of great value in the Copper River district, a few miles west of Smithers, have been reported upon by Mr. John V. Rittenhouse, of New York, a consulting and mining engineer, who has made a thorough examination of the properties of the North Pacific Iron Mines, Ltd.

Winnipeg, Man.—J. R. Colby, managing director of the Canadian Carbonate Co., is completing arrangements for the erection of a plant to manufacture carbonic acid gas in St. Boniface. The building will be erected near the Western Canada Flour Mills, and will be under the management of R. L. Crysler. It will cover 20,000 square feet and at the commencement give employment to about 50 men.

Wood Working

Burlington, Ont.—Fire recently destroyed the planing mill of A. Coates & Sons. Loss $30,000.

Markdale, Ont.—George Watson, of Flesherton, has purchased a site for the erection of a sash and door factory.

Port Arthur, Ont.—The Bertrand-Lockhart Co. has been incorporated with a capital of $75,000. A planing mill will be erected.

Windsor, Ont.—The Windsor Lumber Co. will operate a wholesale and retail lumber business at the south end of Wyandotte street, and will install sufficient machinery to manufacture special work.

Vancouver, B.C.—Fire destroyed the plant of the Westminster Woodworking Co., at Westminster, causing a loss of $75,000. The whole building, which was insured for $40,000, was completely gutted.

Vankleek Hill, Ont.—The sash and door factory and saw mill owned by J. R. McLaurin, jr., was completely destroyed by fire recently. The loss was about $8,000, covered by only $3,000 insurance. The cause of the fire is unknown.

Railways-Bridges

Hamilton, Ont. — George F. Webb is applying to the city for permission to extend his east end incline railway 30 feet lower.

Brantford, Ont.—The citizens of Brantford will be asked to provide $270,000 for the purchase of the street railway from the bondholders.

Deseronto, Ont. — Efforts are being made to secure a bridge to connect Prince Edward County with Hastings County at the old ferry landing near Deseronto.

Fort Frances, Ont.—The C. N. R. will erect a modern coal handling plant and docks at Fort Frances, early next summer, to replace the former dock which was burned.

Arthur, Ont.—The surveying party of the Hydro-Electric Commission has staked out a route for the proposed hydro-electrical railway as far north as Monck.

Hespeler, Ont.—At the regular meeting of Waterloo Township Council, held on Saturday last, it was decided to erect a steel bridge to span the river at Breslau.

Brantford, Ont.—The bondholders of the Grand Valley Railroad last week, recommended that the offer of the city of Brantford for the purchase of the railway be accepted.

Port Coquitlam, B.C.—New plans are now being prepared by the Provincial Government engineers for the proposed $600,000 traffic and highway bridge to be constructed across the Pitt River.

Hamilton, Ont.—The Dominion Power and Transmission Co. announce that an electric railway extension to Galt would

be built, and construction work on a steam plant to develop 88,000 horsepower, and cost $3,500,000, is now under way.

Ottawa, Ont.—A charter has been granted to the Pacific Peace River and Athabasca Railway Co., to construct a railway from Prince Rupert, B.C., to Prince Albert, Sask. D. A. Thomas, of Cardiff, Wales, is interested in the project.

New Westminster, B.C.—Additions to the rolling stock of the B.C. Electric Railway will shortly be made, when ten new cars, being manufactured at Preston, Ont., will arrive in the city. The old cars will be shipped to New Westminster and will be rebuilt.

London, Ont.—The C.P.R. is planning extensions here in the spring which will make London one of the most important points of the system in Ontario. It is understood that five more miles of siding will be put in and the freight sheds greatly extended.

Ottawa, Ont.—An application by the Canadian Pacific Railway to construct a large tunnel in Glacier Park near Roger Pass, has been granted by the Government. The tunnel will be bored through from Beaver Mouth to Ross Creek, mile 74.46 to mile 88.56, a distance of about fourteen miles.

Ottawa, Ont.—In the Commons Railway Committee last week, the C. P. R. was granted a time extension of two years in which to begin work on the Collingwood branch of the Tillsonburg, Lake Erie and Pacific, which now ends at Embro, Ont. The West Ontario Pacific got a similar extension for its proposed line from London to Goderich.

Galt, Ont.—At the Board of Trade meeting on Feb. 11, Dr. Dakin, chairman of the local Hydro-electric Commission, introduced a proposal for the construction of a Hydro radial from Galt to Hamilton. A resolution was passed requesting the town council to get information as to the probable cost from the Ontario Hydro-electric Commission. An effort will be made to interest the other municipalities concerned.

St. Thomas, Ont.—Geo. B. Wood of Toronto, vice-president of the London and Lake Erie Railway and Transportation Co., states that everything is in readiness to proceed with the construction work on the Aylmer extension as soon as the municipalities agree on the amount each is to guarantee of the company's bonds. The radial people are asking for a guarantee of $20,000 per mile.

Transcona, Man.—The law amendments committee last week passed a bill to give power to Transcona to construct, maintain and operate a street railway in the town. A draft clause, added to the bill, giving Winnipeg and Transcona the right to enter into an agreement for the construction of a tram line between the two towns, was not allowed.

Fort William, Ont.—An auxiliary line of street railway, from end to end of the city, will be built, for which the money has been voted and for which debentures will be sold, as soon as the market is favorable. Commencing with the Empire elevator spur, the line will cross Simpson street and follow Pacific Ave., continuing along Dease and North Syndicate to Victoria, thence down Franklin street to the west end.

St. Catharines, Ont.—The reports of City Engineer Near and Mr. Sprague, the Pittsburg bridge expert, were made known at a meeting last week of the city council. The verdict was strongly in favor of the St. Paul street route, connecting the traffic centres of both sides of the canal as the most direct route. A lump sum estimate of the cost was given at $175,000 with the expectation that the G.T.R. will grant $20,000 and the Dominion Government $50,000.

Sarnia, Ont.—A party of Cleveland capitalists are advocating an electric line between Thamesville, in Kent, to Sombra. The proposed road would pass through Euphemia, Dawn, and Sombra Townships, and a small part of Zone Township, north of Thamesville. The promoters want a grant of $50,000 from each of the three Lambton townships directly interested, the amount to be arranged on a sort of assessment plan, based on the proximity of farm property to the right-of-way.

Toronto, Ont.—Seven new bridges to cost over a million dollars were cut out of the estimates of the works and street commissioners last week as follows:—Spadina road, $106,000; North Glen road, $310,000; Sherbourne street, $151,-000; Huntley street, $80,000; St. Clair avenue, Moore Park, $335,000; South Glen road, $80,000, and Winchester street, $71,500. The erection of only one was recommended by the committee. This is for Dundas street, and is estimated to cost $148,000.

Quebec, Que. — New plans have been prepared for the Quebec terminals for the National Transcontinental Railway at a saving of over half a million dollars. The estimated cost of the old scheme was $6,406,152.95. That was for a station on the Champlain Market site and subsidiary works. The new scheme will cost $5,847,250. A station will be put on the market site for river traffic, but the station proper, a union passenger depot, will be built on what is known as the Palais site.

Ottawa, Ont.—Among the bills for new railways in Ontario are the following: The Norfolk and Elgin Railway, which proposes to build a line from Simcoe to Port Burwell; the Bruce Peninsula Railway from Wiarton to Tobermore; the Ontario Railway with two branches, one from Port Maitland to Smithville and second from Point Maitland to Port Colborne; the Ontario Lake Front Co., which proposes a line from a point on the C.P.R. between Havelock and Central Ontario Junction southeast to Cobourg, also another line from the same point to Brighton.

C.P.R. Extension Plans.—C.P.R. extension plans last year and this will involve a total expenditure of around eighty-five million dollars, according to authoritative forecasts current. Vice-President Bury has been in Montreal conferring with President Shaughnessy, but neither as yet has handed out an official statement. The large amount quoted, however, is said to be spread over a number of years, and double-tracking and other parts of the programme will be proceeded with conservatively as the need arises. At the present time there are 133 miles of double track under way between Sudbury and Port Arthur on the Lake Superior division, which alone will cost $6,000,000; 178 miles of double track between Brandon and Calgary, to cost $5,000,000; and 139 miles between Revelstoke and Vancouver, to cost $7,000,000.

Marine

Ottawa, Ont.—The Marine Dept. has to install a 450 c.p. revolving light at Goderich harbor in place of the present

Fort William, Ont.—A bulk freighter with a capacity of 125,000 bushels of wheat will be added to the fleet owned locally by Davidson & Smith.

Ottawa, Ont.—The Dominion Government will make a grant of $15,000,000 to the Montreal Harbor Commission for the completion of harbor improvements and terminal facilities.

Tenders

Saskatoon, Sask.—The City Council invites tenders for the furnishing of goods and material for the year ending 31st December, 1914, under the following contracts:—

1.—Electrical supplies: (a) Copper wire and cable. (b) Poles and cross arms. (c) Transformers. (d) Meters, (e) Sundry electrical supplies. 2.—Hardware supplies.—F. E. Harrison, Mayor.

Vancouver, B.C.—Tenders will be received by the undersigned up to Wednesday, March 4, 1914, for the construction of four viaducts over the Great Northern Railway Co.'s tracks on Hastings, Pender, Keefer and Harris streets, in the city of Vancouver. Wm. McQueen, city clerk.

Ottawa, Ont.—Sealed tenders addressed to the undersigned, and endorsed "Tender for Construction of a 15-inch Hydraulic Self-Propelling Steel Suction Dredge," will be received at this office until 4 p.m. on Tuesday, March 3, 1914, for the construction of a 15-inch Hydraulic Self-Propelling Steel Suction Dredge.—R. C. Desrochers, Secretary, Department of Public Works, Ottawa.

Montreal, Que. — Sealed tenders addressed to the Board of Commissioners will be received until Thursday, March 26, for the supply and delivery of the undermentioned apparatus, viz:—(a)—One automobile salvage wagon; (b)—Four automobile tractors; (c) — Two automobile hose wagons; (d)—One 85-ft. aerial ladder, automobile truck; (e)—One automobile fire engine, of a capacity of 1,200 American gallons. Specifications, forms of tender and envelopes, together with all information required, may be obtained at the office of the purchasing and sales agent, City Hall. L. N. Seneeal, secretary, Board of Commissioners' office.

Trade Gossip

Sarnia, Ont.—The walls, roof and windows of the new plant of the Perfection Stove Co. are finished. A concrete floor is now being laid.

Galt, Ont.—Galt is to have another iron tool company, in which it is said four practical mechanics are interested, three of them being outsiders. The new concern is now looking for a building.

Midland, Ont.—Work on the new plant of the Midland Malleable Iron Co. has been suspended for a time. Already $20,000 has been spent on the plant. The company has asked the town for the first instalment of its loan.

Herbert Morris Crane & Hoist Co., Toronto, advise us that Herbert Morris, Ltd., England, with whom they are associated, have recently received an order for ten 10-ton hand operated overhead travelling cranes and two electric cranes from the London & Southwestern Railway Co., of England.

Alliston, Ont.—A proposition to build a plant for the manufacture of traction engines has been received by the town from a company, who will require at least four acres of land, a building at

Classified Advertisements

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BUFFING AND POLISHING LATHES FOR platers, jewellers and everyone using polishing machines. All sizes in stock, from No. 00 to No. 8. Enclosed type for jewellers, to be driven from below. Our prices are reasonable. Write us. Pendrith Machinery Co., 970 Queen West, Toronto. (11)

MACHINERY FOR SALE—NEW AND SECond-hand machinery, engines, boilers, wood and iron working machinery and supplies. Write, stating what you require. Prompt and careful attention to all inquiries. The Advance Machine Works Co., Montreal, Que.

SITUATIONS VACANT

THERE IS A POSITION WITH GOOD future awaiting some young man who has a knowledge of mechanical engineering and the ability to write intelligent and convincing advertisements describing engineering equipment. The salary at commencement will not be extremely large, but will grow with the man. State full particulars, giving age, experience and salary you would be willing to accept while you demonstrate your ability. Replies will be regarded as confidential. Box 222, Canadian Machinery

CONTRACT WORK, FORGING

THE SUDBURY CONSTRUCTION & MAchinery Co., Ltd., Sudbury, Ont., have an inch and a half upsetting and forging machine they require for their own use about five hours per day. They wish to run this machine day and night and invite correspondence from users of forgings who are looking for an interesting proposition. (10)

least 60x150 ft., a fixed assessment of $2,000, and free water.

Galt, Ont.—The Union Metal Co., of Canton, Ohio, which will establish its Canadian branch in Galt, manufactures pressed metal goods, the chief output being ornamental standards. Temporary quarters have been secured in the plant of the Galt Stove and Furnace Works. A site of three acres has been secured on which a large plant will be erected.

Montreal, Que.—One of the latest firms to enter the motor truck field is Canadian Halley's Motor, Ltd., of 10 Colborne street, who will control the sales of Halley trucks for the Dominion. A service station will be established at Montreal, where a full stock of trucks and spare parts will be on hand. Mechanics trained in the Glasgow factory will be stationed in Montreal.

Vancouver, B.C.—Kenneth L. Burnet, W. D. Burdis and J. D. Magee, of Vancouver, have applied to the Provincial Government for a lease of three islands in the North Arm of the Fraser river. Mr. Burnet states that he and his associates are acting in the interests of an English syndicate that has $100,000 ready to invest s a nucleus in the establishment of extensive shipbuilding yards.

Transcona, Man.—A contingent of G.T.P. employees arrived last week from Melville, Sask., for the car shops. This is a result of the announcement by the N.T.R. to the effect that the railway could utilize all the shops it was prepared to accept as completed. J. H. Hodgson, master car builder, has considerable work on hand, but the shops will not run to their full capacity until late in the spring.

Improved Hack Saw Blade.—A new hard edge flexible hack saw blade is being put on the market by Simonds Canada Saw Co. of Montreal, Que. The chief feature about this blade is that it will do the cutting work of the regular hard blade, and in addition is so flexible that it can be bent a great many times without breaking, thus eliminating a large percentage of the breakage which confronts users of hack saw blades. The Simonds hard edge flexible blade is made in the standard lengths and numbers of teeth per inch.

Record Manganese Steel Crossing.—A manganese steel crossing of record size has been manufactured by Edgar Allen & Co., Ltd., Sheffield, England, for the Buenos Aires Great Southern Railway. The rails weigh 100 lb. per yd., and the layout comprises eight sets of 18-ft. switches, four sets of 12-ft. switches, two acute, 14 obtuse, and two compounded triple crossings and closure rails, the whole thus including eight turnouts and eight diamonds. The total length is 432 ft. 1¾ in., while the width at one end is 63 ft. 5⅝in, and the other 64 ft. 3½ in.

The Gramm Motor Truck Co., of Canada, Ltd., Walkerville, Ont., have opened a branch office in the Continental Life Building, Toronto, with Mr. F. H. Galusha, secretary-treasurer of the company, in charge. Mr. J. Del. Warren has been appointed sales manager with headquarters in Toronto. The company has also opened a service station and garage at 162 Cumberland avenue, where trucks for demonstration purposes will always be available for customers. Mechanics from the factory will be stationed there and a complete stock of spare parts will be carried.

Wabana Ore in the United States.—The Dominion Iron and Steel Co. will, we understand, offer about 150,000 tons of its Wabana iron ore in the Eastern market for shipment this year and Naylor & Co., New York, have been appointed selling agents. This is the first time the company has put any of its ore on the market, the Wabana ores heretofore sold in the United States and Germany being those of the Nova Scotia Steel & Coal Co. The two companies are mining the extensive Belle Island deposits which extend some distance under the sea at Conception Bay, and mining by the Nova Scotia Steel and Coal Co. is now carried on at a distance of two miles from shore. The Dominion Iron and Steel Co.'s ore which Naylor & Co. will offer, runs from 49 to 52 per cent. metallic iron, 11.5 to 1. per cent. silica, 0.01 to 0.05 sulphur, 2 to 3 per cent. lime, 0.65 to 0.90 phosphorus, and about

Russian Pig Iron.—At a meeting of the conference to consider the scarcity of pig iron in Russia, it was stated that the estimated requirements during 1914 of the Ministry of Ways and Communications were 1,016,130 tons of rails, fittings, axles, and the like (besides bolts and nuts) for state and private railways and for new lines, and an additional 32,250 tons of rails for town tramways. Apart from official requirements, there would probably be a demand during 1914 for 290,300 tons of girders, 306,450 tons of wire, 403,250 tons of roofing iron, 1,129,000 tons of assorted iron, 244,930 tons of unassorted iron, 435,480 tons of sheet iron, and 96,940 tons of universal iron, making a total of 2,903,-200 tons. Of pig iron for casting purposes, 741,930 tons would be required, also 89,645 tons of steel castings. Beyond agreeing that measures must be adopted for reducing the price of the raw material, and discussing the question of petitioning for a reduction of the import duties, no definite conclusions appear to have been reached.

New Incorporations

The Seelye Combination Tool and Axe Co., Ltd., incorporated at Toronto to manufacture woodmen's tools and implements at Sault Ste. Marie, Ont.

The Cedars Construction Co., Ltd., incorporated at Ottawa, with a capital of $50,000 to construct dams, etc., and develop water powers. Incorporators: E. S. McDougall, Francis G. Bush, etc., Montreal.

The Frontenac Mica Co., Ltd., incorporated at Toronto, capital $50,000, to acquire and operate mines and mineral lands at Sydenham, Ont. Incorporators: George A. Grover, James Y. Murdoch, etc., Toronto.

The Western Mica Corporation, Ltd., incorporated at Ottawa, capital $1,100,-000, to acquire, and develop mines at Lewisville, N.B. Incorporators: John D. DeWitt, Nutley, N.J., Frederick W. Winter, Moncton, N.B., etc.

The Northern Ontario Pulp & Development Co., Ltd., incorporated at Toronto, capital $150,000, to carry on the business of pulp and paper manufacturers at Toronto. Incorporators: Harold E. Manning, Bert H. L. Symmes, etc., Toronto.

The Central Ice and Cold Storage Co., Ltd., incorporated at Toronto, capital $500,000, to carry on the business of manufacturing artificial ice and distilled water, at Windsor, Ont. Incorporators: Sutherland Cuddy, Victor G. Pinney, etc., Windsor, Ont.

The Canadian Traylor Engineering & Mfg. Co. Ltd., incorporated at Ottawa, capital $50,000, to manufacture, and import all kinds of machines and machinery, at Montreal. Incorporators: Thomas J. Mullen, Harry Grant, etc., Montreal, Que.

The Ontario Tire & Rubber Co., Ltd., incorporated at Toronto, capital $750,-000, to carry on business as rubber producers, manufacturers and dealers in rubber goods, at Welland, Ont. Incorporators: Thomas J. Costello, Robert Cooper, etc., Welland.

The Stoness Anglin Gilbert Mica Mining Co., Ltd., incorporated at Toronto, capital $90,000, to acquire and develop mines and mineral lands, at Kingston, Ont. Incorporators: John H. Stoness, Loughborough, Ont., John E. Anglin, Storrington, Ont., etc.

McLauthlin Elevators, Ltd., incorporated at Ottawa, capital $50,000, to carry on the business of manufacturers of all kinds of elevators, lifts, hoists, dumb waiters, friction whips, escalators, traveling staircases, etc., at Montreal, Que. Incorporators: Eratus E. Howard, Jacob DeWitt, etc., Montreal.

Concerning the Power Feature in Iron Works Operation--I*

By Frank Anslow

In steel making, the actual fuel cost for rolling and finishing, excluding reheating, has been shown to amount to only $5\frac{1}{2}$ per cent. of the total production cost. A similar record is not, however, available, relative to puddling and finishing iron, but even were this equally low, there is believed to be ample scope to effect considerable economy. Towards this the data contained in the accompany article is directed.

WE ARE far beyond the period of high selling prices and low fuel cost, when all the heat generated in the puddling furnaces was allowed to go to waste. Increased cost of fuel and keen competition long since rendered such wastage prohibitive, and the principle of utilizing the waste heat for generating steam in boilers is now accepted. The boilers in the earlier stages were crude in form and badly arranged, but have gradually been superseded and remodeled, until, at the present time, with perhaps occasional exceptions, all furnaces are equipped with boilers of a more or less efficient type.

How much steam can be generated from the waste heat is a matter of controversy, quantities as widely divergent as $2\frac{1}{2}$ lbs. and 8 lbs. of steam per lb. of coal used in the puddling furnaces having been authoritatively stated and equally authoritatively denied. A possible reason for this is that the necessity for knowing the exact quantity—at least in the terms of pounds of steam per pound of coal—has not arisen or been appreciated. The steam generated is used for processes subsequent to the puddling, and so long as there is a sufficiency for this purpose the actual quantity is not material. Considered from this point of view only, all is well if—and so long as—the supply meets the demand; but as soon as the steam generated fails to cope with the requirements the matter assumes importance and some means of increasing or augmenting the supply must be considered. The usual procedure is either to add additional puddling furnaces or alternatively to supplement the steam-raising plant by hand-fired boilers. Assuming a remunerative market for the additional output, there is generally no objection to the former alternative, but the latter represents an additional cost that should not be tolerated unless, or until, everything possible has been done to improve the steam-raising and steam-using conditions.

The Boiler Feature.

Taking these in detail, the first consideration is the boilers. Limitations of space and arrangement and type of furnaces frequently preclude much-needed reform in the boiler plant. The installation of new boilers in such cases is difficult, as, in addition to being costly, it causes inconvenient stoppages. Whenever possible, however, this should be done, the new boilers being of the best type and suitable for high steam pressure. This is being generally recognized and taken advantage of. Tubular boilers, giving greater evaporation, have been adopted, both in connection with puddling and heating furnaces, but their success under arduous conditions, and with bad water has, so far as the author is aware, yet to be proved. Forced draught, which has been successfully applied to puddling furnaces in some works, has the advantage of accelerating the puddling process, allowing a cheaper class of coal to be used, and also increasing the steam-raising capacity of the boilers attached to the furnaces. In passing, the desirability of attention to flues may be emphasized.

Feed Water Feature.

The next point, that of feed water, must be considered from the point of view of temperature, and also of cleanliness and suitability for boiler feed purposes. The impurities in feed water are twofold—namely, those held in suspension which may be removed by settling or filtration, and others of a chemical nature requiring some purifying re-agent for elimination. Many simple arrangements have been devised for improving the circulation of water in boilers, some of which claim not only to do this, but, at the same time to remove impurities in the form of suspended matter from the water.

Water requiring chemical treatment is a more difficult problem, and purifying apparatus should only be decided upon after careful investigation, as apparatus which has entered successfully into one case may be a failure in another. That each 1/16-inch uniform thickness of scale affects the evaporation of a boiler as much as 9 per cent. is in itself convincing evidence that a plant to eliminate the impurity causing this scale will, on the point of efficiency alone, without considering saving in boiler cleaning and upkeep, pay for itself in a very short time. The importance of raising the temperature of feed water to as near boiling point as possible before entering the boilers cannot be overrated. Under certain circumstances economizers may be used to increase the temperature with good results.

Steam Transmission Lines.

Assuming that the steam-raising plant has been improved as far as circumstances will permit, the next link in the chain is the pipe line conveying steam to varous parts of the works. Condensation in the pipe line is a continuous loss, whether the engines are working or standing, and constitutes a serious wastage. A record taken over, say, 12 or 24 hours of coal required to maintain a steady steam pressure with all plant standing will demonstrate the importance of this. The test, with proper supervision, is a practical one, and can easily be carried out wherever a hand-fired boiler is available.

The examination and improvement of the steam-raising and transmitting plant may restore the equilibrium of supply and demand, and even produce a surplus of steam which can be utilized in various ways. Should there, however, still be a shortage of steam, it is necessary to investigate the steam-using plant, consisting of rolling mill engines, steam hammers, and auxiliary engines.

Hammer and Auxiliary Engine Improvements.

Improvements to steam hammers may be in the direction of thorough overhaul and attention to matters of detail with a view to reducing the steam consumption as much as possible and also utilizing the exhaust steam either for feed-water heating or other purposes. The pneumatic hammer has been developed during recent years, and is now applied with successful results to forging and shingling. This opens out many possibilities.

Improvements in connection with the small auxiliary steam engines driving shears, etc., are difficult. With long lengths of steam pipes and intermittent working, they absorb a considerable portion of the total steam generated, and, lending, themselves, as they do, particularly well to electric driving, they should receive close attention, particularly if an outside source of electric supply is available, which makes them available at all times for immediate work independent of other parts of the plant.

The Mill Engine.

Coming now to the mill engines them-

*From a paper read before the Staffordshire Iron & Steel Institute.

selves. The old beam engine is still employed to a considerable extent in some districts of England, in fact, very few works are without one or more of this class of engine. It is the first object of attack by the would-be reformer and advocate of other forms of power, and many more obvious sources of waste are overlooked in order to root out this—in their opinion—uneconomical and cumbersome plant. This is a mistaken view. Fitted with a condenser, and properly maintained, this engine may still hold its own for economy with many of our modern prime movers. Naturally there are reasons which may be successfully advocated for its displacement; for instance, it may be too small for its work, or too costly in upkeep.

Steam Consumption.

To ascertain the steam consumption of mill engines is a difficult problem—excepting in the rare cases when surface condensing plant is available, in which event the condensed steam may be measured, and thus the exact steam consumption is determined. Indicator cards for this purpose are of little or no assistance. The measurement of steam by steam meters is rapidly becoming practicable. Much useful information may be obtained by their use, and having recently found it necessary to closely investigate their possibilities, the author would, if space permitted, go more fully into the subject.

Having by one or other of these means ascertained the conditions of the engines and made them work as economically as possible, further economies may be attained by superheating the steam and by adding condensing plant where it has not been previously fitted, if circumstances permit. Sometimes it is advantageous to convert simple engines into compound engines, this being especially so when it is possible to increase the steam pressure. Compounding can be arranged either to secure more economical results or to increase the power of the engine, in which case consideration must be given to the strength of other parts of the engine. This question of compounding should be considered with due regard to other matters and possible future requirements.

Summarizing the above, we have the possibility of securing increase in power or saving in fuel to the extent of, say 50 per cent., much or all of which may be taken advantage of, dependent upon the particular conditions, and amounting in a plant producing, say, 40,000 lb. of steam per hour to, say, 600 to 700 h.p., or, say, $10,000 per annum, the amount varying in proportion to the economies it is possible to effect.

So much then for the position as it stands. It is only necessary to add that the conditions may be such as to prevent the reforms reviewed above being carried out to a successful issue, but we will proceed on the assumption that everything practicable has been done to improve the existing steam-raising and steam-using plant, and that there is still a shortage of steam.

Securing Additional Power.

The methods at present available for securing additional power, or utilizing to better advantage the existing steam supply are varied, the whole of which the author has from time to time found it necessary to investigate and apply. They may be summarized under a few main heads:—

Securing Additional Power.

(1)—Use of the live steam in new and economical engines, with condensing plant.

(2)—Use of the live and exhaust steam in turbines for driving the mills direct through gearing.

(3)—Use of the live and exhaust steam in turbines for generating electric power, and driving the mills by means of electric motors.

(4)—Augmentation of existing power by a supply of electricity.

All these schemes and combinations thereof having features specially applicable to the varying conditions encountered render a general comparison impossible, so, as an alternative, it is proposed to describe some typical and representative plants which have been successfully working for a number of years, and to comment upon their main characteristics. It is not necessary to enter into the details of the ordinary type of simple or compound engines referred to under head one. Their application, at least to those conversant with latest practice, is well known. We will, therefore, turn to more recent innovations.

The High-Speed Engine.

The most notable departure within recent years is the application of the high-speed engine to rolling mill work. The advantage of this, for both quick and slow running mills, is at once apparent; gearing may be eliminated and weight and space economized. The first application of the high-speed engine to such work, although not strictly speaking rolling mill work, is closely allied thereto, refers to a plant designed to solve a somewhat complicated problem in connection with the equipment of Rothesay Dock, belonging to the Clyde Navigation Trustees, and was eventually decided upon by their consulting engineer, after close collaboration with the present author.

The generating plant consists of a high-speed triple-expansion engine direct coupled to a generator which is used for generating current for ordinary purposes. By means of a flexible coupling attached to the shaft of this generator, in turn is connected a large fly-wheel and two special generators supplying current to plants which require a large amount of power for short periods. The engine is capable of developing about 450 B.h.p., as a normal load at a speed varying between 375 and 320 r.p.m. The combined output of the three generators is about 1,200 h.p., and the flywheel is designed to equalize these loads and thus ensure a constant load on the engine. The plant has several interesting features, mainly due to the arrangements necessary to cause the requisite drop in speed to permit the flywheel to give out its energy. The application of such a plant, especially where heavy loads have to be equalized, offers many advantages.

Direct Drive by Turbine.

With regard to the use of live and exhaust steam in turbines for direct driving, the introduction of suitable and efficient gearing developed originally for marine work has allowed the steam turbine to be applied to rolling mill work. The mill to which the turbine is coupled, is a plate mill of the three-high type, having rolls 28 in. diameter by 84 in long. The steam turbine is of the mixed pressure type running at 2,000 r.p.m., which speed is reduced by a double set of gearing to 70 revs., at the mill. The origin of the scheme was to utilize the exhaust steam from existing mills, and, at first, it was proposed to have an electrical scheme, but, for various, and in this case quite cogent, reasons, it was finally decided to adopt the geared turbine drive. The plant has been running for a number of years and, since the preliminary adjustments were made, with quite successful results.

The advantage of this direct utilization of steam either in engines or turbines is an absence of the conversion losses met with in a turbo electric scheme, and also a somewhat less capital expenditure. On the other hand the use of the steam is limited to this particular duty or mill, whereas the scope of the turbo electric arrangement is more extensive. In other words if the plant is simply one unit, then it may be quite satisfactory and economical; if, however, it forms only part of a scheme, other and greater advantage may possibly be obtained by means of electrical generation and transmission.

C. N. Monserratt, chairman of the Quebec Bridge Commission, lectured on the foundation work in connection with the building of the structure before the Toronto branch of the Canadian Society of Civil Engineers at a well-attended meeting of members, on the evening of February 25. The lecture embraced illustrations of various operation features.

The Place and Part of Electricity in Iron Foundries*

By D. B. Rushmore **

A wide range of application of electrically-operated machines, tools and equipment is dealt with in the accompanying article, and while some of the services are generally associated with, at least our large and more modern iron foundry installations, the presentation of the subject as a whole will not fail to arouse a further and possibly keener interest in the continuous progress being recorded in electrically aided production methods.

CONCURRENT with what has taken place in so many other industries, so has electricity entered into every nook and corner of the iron foundry. Lights, cranes, lifting magnets, cupola blowers, exhausters, sand mixers, sand blenders, sand mill screens, elevators, sand sifters conveyors, sand cutters, vibrators or jolt ramming tumblers, sand blast machines, grinders, rope haulage systems, locomotives, high pressure air compressors, etc., all are operated by electricity as a matter of course. Even the heating of metals is being accomplished by electricity. One by one has electricity been adapted as the motive force for these various machines and the present successful state of the art has been the result of much experience sad as well as joyful. It can now be said that every machine of the foundry has been mastered, and, so well are the general requirements of foundries understood that electrical machinery has no trouble whatsoever in keeping pace with new developments in foundry machinery which come up from time to time.

I cannot in a limited space give an exhaustive account of every device on which electricity has been used, but I will try to discuss some of the most important and most recent applications. In passing, I would say that electric motors for use in foundry rooms should have dust proof bearings; all direct current motors should if feasible be totally enclosed on account of their commutators, although alternating current motors have been giving successful operation for a long time with only their bearings enclosed. I would say also that intelligent care of motors is always rewarded. Bearings which are exposed to cutting dust should be inspected and protected and motors not in use may be with profit covered with canvas.

Lighting.

One of the most necessary things around a foundry is light, and artificial lighting is a very hard problem because early in the morning the air is filled with sand and late in the afternoon when no artificial light is needed the air is clearer, therefore, artificial light should be better than daylight.

For general illumination, a very powerful penetrating light is needed. The yellow flaming arc is considered best for this in large rooms where the lamps can be hung 20 feet or over above the floor and the 500-watt Mazda in reflector covered with porcelain is best in small or low rooms and sidebays. Yellow has a peculiar ability to penetrate the fumes and dust.

The lamps should be spaced symmetrically but care should be taken not to make the illumination too even. Many units hung too high cause such an even or well diffused illumination on the working plane that the molders cannot clearly see the lines and curves of molds and patterns. It is, therefore, better where possible to use a few large units than many small ones. However, no general overhead illumination can take care of all requirements, and it is wise to provide plugs at convenient places so that workmen can use small lights for working on the inside of molds.

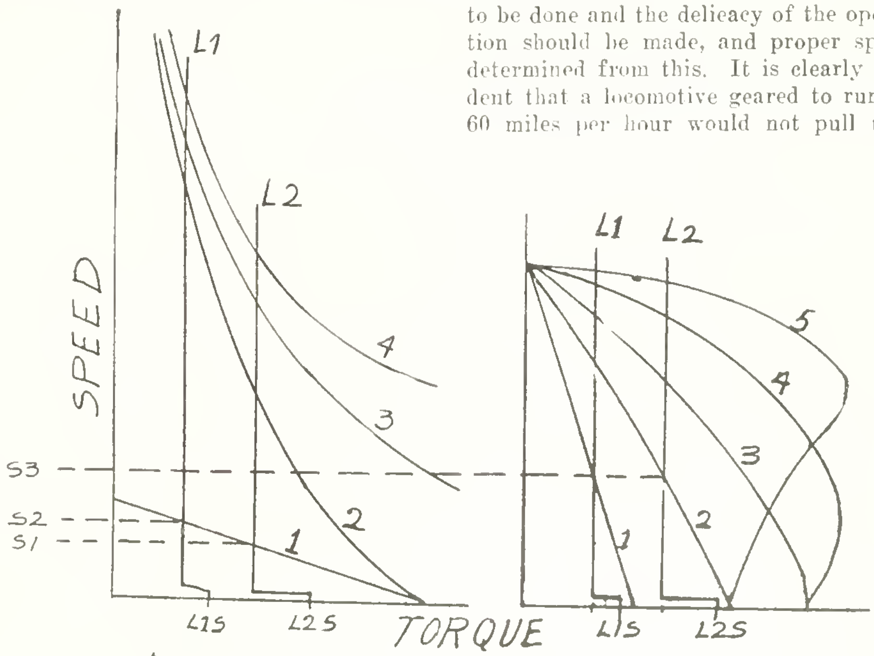


Fig. 1 D.C Fig. 2 A.C.

SPEED CONTROL DIAGRAM

Cranes.

The most important machine in a foundry is the crane, and for this electricity is well suited. The electric traveling crane has marked a revolution in every plant into which it has entered. No other motive power is even considered, no operation being too delicate and no load too heavy. As the crane is the most important as well as one of the most expensive machines in a foundry, a very careful scientific study of requirements should be made before selection is made. The distribution of heavy and light cranes over the floor should be made to suit the work. A very good solution of this problem is to have large overhead cranes and small side-wall traveling cranes which serve as messengers to the large cranes and which can pass under the latter.

Hook speed is of vital importance. A careful analysis of the amount of work to be done and the delicacy of the operation should be made, and proper speed determined from this. It is clearly evident that a locomotive geared to run at 60 miles per hour would not pull uniformly and slowly enough when drawing a thin pattern, and this speed would be of no advantage in hastening the work. Forty feet per minute is a speed which has met with general favor for 5-ton cranes, and even 60-ft. per minute is in use in a merchant foundry where every conceivable kind of work is done. Fifteen feet per minute is quite common on larger cranes. The only trouble with these higher speeds is that at times speeds of from 1 to 5-ft. per minute must be obtained for drawing patterns, etc. With direct current it is not so hard to obtain this speed, but with alternating current it is very hard unless the crane is geared for a slower speed

*From a recent paper read before the Philadelphia Foundrymen's Association.

**Power and Mining Department, General Electric Co., Schenectady, N Y

than the d.c. crane, and even although the most-up-to-date cranes, brakes and controllers be used. I know of a case where a crane is designed to take care of just one kind of work. It was at first thought that 40-ft. per minute hook speed should be used, but on investigation it was shown that 12-ft. per minute would do just as much work in a day and would give ideal control on delicate operations, whereas 40-ft. per minute would have caused a large percentage of lost molds.

As already mentioned d.c. is better as regards creeping speeds than a.c., but if the mechanical load brake be good, and if the proper hook speed be used, there are few cases where it is necessary to go to any extra expense to obtain d.c. if a.c. is the form in which power is generated. Still there are some cases where it is best to use d.c. The General Electric foundry at Erie is entirely a.c.; at Schenectady, it is entirely d.c., and at Pittsfield it is mixed a.c. and d.c. These systems were not chosen on account of foundry requirements at all. The foundry was made to conform to the remainder of the plant.

The accompanying illustration shows the difference between speed control of an a.c. crane, and that of a d.c. crane. In Fig. 1 curves are plotted between torque on motor shaft and speed in r.p.m. Curves 1, 2, 3 and 4 represent speed conditions on points 1, 2, 3 and 4 of a controller. Curve 1 is obtained by connecting resistance in series and in shunt with the armature. Curves 2, 3, 4, are obtained by series resistance. Vertical lines L1 and L2 represent torque required to raise a light and a heavy load respectively. L1s. and L2s. the torque required to break static friction on L1. and L2. It will be seen that the speed where curve 1 crosses L1. and L2. is very nearly the same. Fig. 2 is made in the same manner for a.c., but no such expedient is obtainable for curve 1. It must be obtained by series resistance and is steep instead of flat. Therefore point 1 of the controller will give a creeping speed for light load, but point 2 must be used for heavy load, L2. Even then the speeds are not so slow as point 1. d.c., but within limits just as slow a speed can be obtained by turning the controller "on" and "off" rapidly, and this is done frequently in practice, but requires more care and more skill of the operator.

Where it is strictly required that the creeping speed does not exceed a fixed low percentage of full speed, d.c. is the only solution. How long this percentage must be to make d.c. imperative depends largely on the crane builder and on the ratio of L1s. to L1, and L2s. to L2. If a great deal more torque is required to start a load than to hoist it, the a.c. crane will jump, as it were, much more than the d.c. crane.

In general, a.c. is the best form in which to use power because it is cheaper than d.c. On all other machines except the crane, there is no doubt but that a.c. motors are better than d.c., because nothing about them except their bearings are hurt by foundry dust, whereas d.c. motors must be enclosed on account of their commutators if they are exposed to this dust.

Air Compressor.

Any large continuous running machines like the air compressor may well be driven by a synchronous motor and they should be installed as far away from the dirt as possible. This type of motor can be made to have a leading power factor and thereby compensate for the lagging power factor of the induction motors which are used in other parts of the shop. This feature is especially valuable when central station power is used, or where the motors are installed at a great distance from the power station, because it helps the line regulation and reduces the line losses.

Exhaust Fans and Blowers.

Where exhaust fans are required, it is usually advisable to sectionalize the system and operate relatively small blowers individually by means of direct connected motors in preference to large blowers serving single systems. In this way, the pressure required in different sections of the plant can be readily adjusted by varying the speeds of the driving motors, and, when only one portion of the plant is in operation, the cost of current incurred for this service will be directly proportional to the useful volumes of air exhausted. This method of individual drive is used economically all over the foundry on tumblers, conveyors, grinders, etc.

Centrifugal Compressor.

In the last few years there has been developed the centrifugal compressor. It has followed closely on the heels of the steam turbine and the centrifugal pump. Its operation is practically the reverse of the former and just about like the latter. The growing demand for centrifugal air compressors for cupola service is due to the many advantages inherent in this type. One of the striking features of these compressors is their high efficiency which they are capable of maintaining for years without renewals. This high efficiency is due to the fact that, unlike the ordinary fan or blower, they are capable of recovering in the form of pressure nearly all the velocity energy imparted to the air instead of dissipating it in the form of heat. Owing to the absence of valves and rubbing surfaces there is no possibility of leakage, with the consequent slippage and necessity for renewals; the compressors, therefore, maintain their initial efficiency indefinitely.

Other advantages of the centrifugal compressors are their small size for a given output and their high speed; the latter permitting the use of direct connected high speed drivers. They require no belting or gears with their consequent loss of power, cost of upkeep, space occupied and noise, and therefore are more durable, easier to maintain and operate more efficiently than the old type of cumbersome blowers. For these reasons they appeal strongly to all possible users.

Sets with pressure of about one pound are especially adapted to foundry cupola service on account of the non-pulsating character of the blast. Adjustment of pressure can be obtained by changing the speed of the set by means of the motor field rheostat in the case of direct current drive. This feature is not required in all foundries, although it is considered essential in some. Induction motor driven sets are arranged for constant speed and pressure, and have given entire satisfaction on cupola service. Where reduction of pressure is required, it is accomplished by manipulation of the blast gate. An actual capacity of 400 cu. ft. free air per minute is generally sufficient for each ton of iron melted per hour.

The most important advantage of these compressors is the extreme steadiness of the blast. This causes the continuous descent of the charge in the cupola and the steady melting of iron producing therefore more uniform and satisfactory conditions of the latter. In addition to this advantage, centrifugal compressors recommend themselves strongly for this class of service because of their saving in floor space, cost of foundations, and maintenance expense. The centrifugal type of compressor is well adapted for supplying combustion air to oil or gas fired core ovens, and the compact arrangement of a motor driven compressor ests permits its installation close to the core oven where it occupies but little space and is under the immedate control of the core oven attendant.

Miscellaneous Tools.

Many types of portable tools which are great labor savers are on the market such as sand shifters, sand cutters, etc. A well designed foundry should have connection terminals located conveniently for these machines. An instance of economy obtained by using electricity instead of air is the case of a jarring machine driven by a 10 h.p.

(Continued on page 231.)

Development, Application and Testing of Pneumatic Tools-III*

By H. I. Brackenbury

Pneumatic appliances and apparatus adapted to one or more stages in the manufacture of mechanical and general industrial products determine by their installation in a plant, just to what extent the management of the latter are keeping pace with the progress and development being made in this particular sphere. Applied compressed air claims equal classification with electricity in the revolutionizing of manufacturing methods.

PARTS I. and II. of this article dealt with the historical and practical adaptation features of pneumatic tool equipment. In the present and concluding section, the questions of efficiency, testing, selection for specific service, and the need of, because apparent room for, considerable improvement in various purpose applications, are discussed.

Pneumatic Drill Types.

Pneumatic drills may be divided into two classes. The first class comprises those operated by an engine of the piston and crank-shaft type, the second those which rely upon some form of rotary engine. The second type is attractive on account of its beautiful simplicity, but, so far, the author has not found one capable of giving as large a torque for a given air consumption as those of the first type. The principal difficulty in producing even a reasonably efficient rotary pneumatic engine is the large leakage, which seems almost inevitable.

The best example of the results of this difficulty which has come within the experience of the author was a certain drill which would allow the passage of practically the same volume of air per minute when it was stalled as when it was running. Possibly this was a poor example of its kind, though it must be admitted that, if provided with a sufficient supply of air, it was capable of doing excellent work. The concern that rejoiced in its possession appeared to use it alternately with a pneumatic hammer of another make. The air-compressor was incapable of driving both simultaneously.

In considering the efficiency to be expected from either type, we should remember that the problems to be faced by the manufacturer of an engine as minute as that required for a pneumatic drill are peculiar to the production of any very small device operated by a fluid under pressure. Since the periphery of a body is proportional to its linear dimensions, while its area varies as their square, it follows that the leakage which occurs at a periphery assumes greater and greater relative importance as the size of the part decreases. Thus, suppose we have two pistons, one 1 in. in diameter and the other 2 in. in diameter, each working without piston rings in a cylinder 0.001 in. larger in diameter. Their areas are respectively 0.785 sq. in. and 3.141 sq. in., while the areas of the clearances are 0.003 sq. in. and 0.006 sq. in. i.e., the clearance of the smaller area is 0.382 per cent. of its area, while that of the larger is only 0.191 per cent. of its area. Further, if the pistons are similar in shape, their lengths will be proportional to their diameter, and any air escaping round the larger piston will have to travel twice the distance that is traversed by the leak round the smaller one. Consequently the waste of air will bear a much greater proportion to that usefully employed in the case of the smaller piston as compared with the larger—in fact, the ratio will be probably more than four times as great.

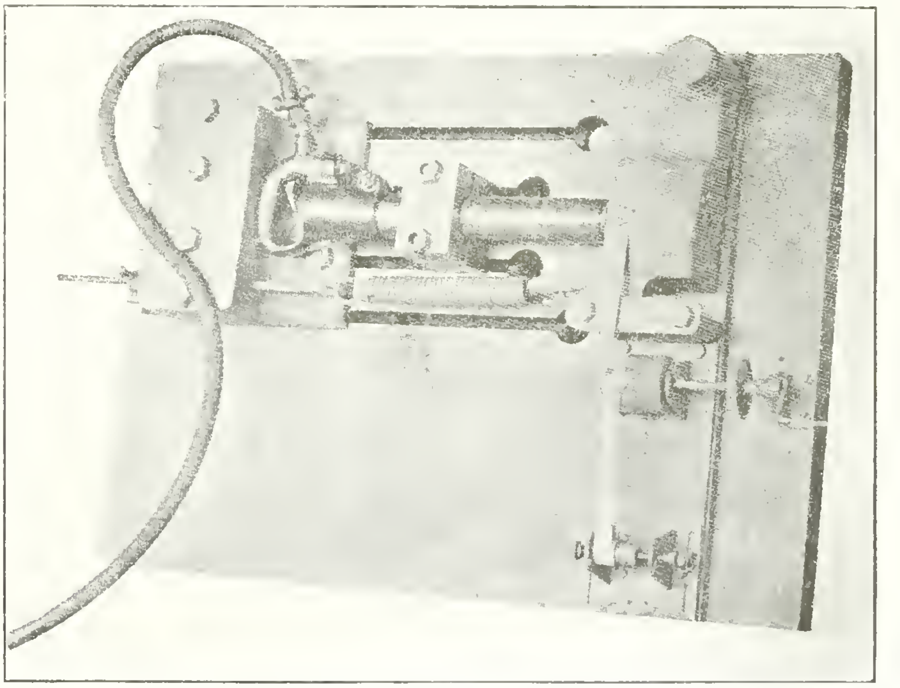


FIG. 14. APPARATUS FOR TESTING PNEUMATIC HAMMERS.

We see, then, that as far as leakage is concerned, we must not expect as good results from a small engine as from a large one, and, in fact, it is found that leakage is the principal bugbear of the designer of pneumatic tools.

Available Energy in Compressed Air.

Compressed air, as is well known, contains, or may contain, available energy in three forms—viz., kinetic energy due to the velocity of its flow; internal energy, which it can give up on expansion; and the energy due to its pressure and volume, which it can transmit to a piston without expanding. The third type of energy is comparable with that transmitted by the water in an hydraulic pressure main. In most tools as designed at present, this third form of energy is the principal source of power. The purchaser has demanded the maximum possible torque, combined with a minimum size and weight, to gain which all considerations of ideal efficiency have been sacrificed. This has prevented the employment to any large extent of the expansive energy of the working fluid. However, it is possible that another difficulty, now to be considered, has hindered the development of a more efficient thermo dynamic cycle.

The exhaust outlet of a drill, working during cold weather, is frequently coated with hoar-frost, and cases are not very rare of some types of drills actually freezing up. In testing a drill in Russia, it was found that the exhaust playing on the inlet pipes had cooled it to such an extent that the pipe was blocked by a cylinder of ice, the moisture in the incoming air having, evidently, been condensed and frozen. This is not due, as is often thought, to the lowering of

*From a paper read recently before the Coventry Engineering Society.

the temperature of the air during adiabatic expansion in the cylinders. The expansion ratio is never sufficient to produce such an effect; in fact, there is seldom any expansion at all.

The cause of the trouble is that the air escaping through the exhaust port expands rapidly and gathers velocity up to an enormous figure. Now the kinetic energy, which the air then possesses, due to its high speed, is produced at the expense of the internal energy, which it previously contained when under pressure. Consequently, when the exhaust air is rushing along its way to the atmosphere, its internal energy must be much less than when it was in the cylinder. It follows that its temperature must drop. This, of course, is perfectly well known to the most elementary student of thermodynamics, but it may be worth while to follow the application of the theory to this particular case. If the exhaust air could be brought to rest by causing its kinetic energy to be degraded into heat by means of friction, then its temperature would again rise until it was very nearly equal to what it had been in the cylinder of the drill, the slight difference being, of course, known as the Joule-Thomson effect. The difficulty would probably be to bring this about without producing a back pressure on the piston.

The exhaust of the pneumatic drill may cause the designer other difficulties besides freezing up. Many drills, as already stated, work with practically no expansion. It follows that, the moment the exhaust-port is uncovered, the cylinder must clear itself as quickly as possible of its contents, but the air in escaping expands, so that, in order to avoid all back pressure on the return stroke, the area of the exhaust port would have to be enormous.

If we remember that during the working stroke of a petrol-engine, the gases are expanding and losing heat to the walls of the cylinder, and yet the exhaust-valve has to be designed with a quick lift, and a diameter about one-third of that of the cylinder, we shall realize the difficulties in the case of the pneumatic drill. Unfortunately, the minute size of the latter—apart from other difficulties—renders it almost hopeless to try to take indicator diagrams, so that we cannot be sure exactly as to what goes on in the cylinder. However, it seems highly probable that in most types the back pressure increases very rapidly with increase of speed of running. It should be worth while to try to make a drill with much larger exhaust-valves than are at present used, provided with a high gear ratio, so that the engine, which would be smaller than usual, would run at a higher speed without increasing the speed of the drill. Possibly this would lead to smaller proportional leakage losses, since in a given design these should be nearly constant, while the useful air-consumption should be approximately proportional to the speed.

Thermodynamic Efficiency.

Some of the difficulties inherent to the design of pneumatic tools have already been considered, but no reference has been made to the possible thermodynamic efficiency of these machines. This depends, of course, upon the cycle adopted for their operation. Now it must be distinctly understood that, however much importance we may attach to efficiency in the case of these particular machines, the primary consideration is the attainment of large power for small weight and size. We are therefore prohibited from employing a high expansion ratio, if, indeed, it be worth while to expand the air at all. Further, the rapid lowering of the temperature of the air on expansion would limit this ratio, apart from other considerations. Obviously the possible thermodynamic efficiency is largely decreased by this limitation. Moreover, the proportion of the total energy contained in the air which is available for useful work decreases with increase in the air pressure. The whole of the theory of this subject is perfectly well known already, and can be found in any standard book.

Testing Pneumatic Drills.

The measurement of the brake horse-power of a pneumatic drill offers no particular difficulty if great accuracy be not required. For commercial purposes a prony brake is quite satisfactory. If, however, it be desired to investigate comparatively small changes of brake horse-power, a number of difficulties have to be surmounted. Two forms of brake have been tried. The first consisted of a hollow copper jacket resting on a sheave, which was driven by the drill. The axle of the sheave on one side ran in a single "Skefko" ball-bearing, while the other end was turned to a Morse taper to fit into the drill-chuck. The back centre of the drill abutted on a support carried on an old lathe shifting-head. The whole arrangement was fitted to a discarded lathe-bed. Arrangements were made to keep a stream of cold water flowing continuously through the copper jacket. The latter was lined with lead, so as to bear evenly on the sheave. To one end of this copper jacket there was attached a heavy weight resting on a spring-balance, while a lighter weight attached to the other end was immersed in a vessel of oil, which damped down the oscillations until they did not exceed about 1/4 lb. on the spring balance. Of course the lighter weight was corrected for the up-thrust of the oil.

This arrangement was only fairly satisfactory. It was adopted originally in an endeavor to keep the coefficient of friction constant. However, in spite of the water-cooling of the brake, the temperature of the sheave rose slightly, and the load varied a little during a run. Greater difficulty was caused by the wear of the brake.

The apparatus at present under trial is shown in Fig. 13. The brake used with it consists of a fine-quality cotton webbing, and the sheave has been made of larger diameter so as to minimize the rise of temperature. Both with this and the former brake elaborate precautions must be taken to prevent oil or water reaching the surface of the sheave, even contact with the hand altering the coefficient of friction. It is intended to substitute ball-bearings for the present plain bearings, and to make better arrangements for taking up the stretch of the belt. Probably, also, it will be necessary to introduce some spring control on the brake, though the running is much more stable than might be expected. The curves shown in Fig. 10 were obtained with the earlier apparatus. They show somewhat roughly, the general effect on the brake horse-power of a certain drill, of variations in air pressure and of rate of running. It will be easily understood that it is not always possible to devote as much time as one would like to this class of work, and the author regrets that he cannot exhibit more comparative results of brake horse-power tests. For such work it is of a first importance to secure an absolutely steady pressure of air, which is by no means easy, and then the drill must be run until the bearings are at a steady temperature, which requires some time. The curves in Fig. 10 show that over the speed range under investigation, the horse-power developed by the drill increases more slowly than the revolutions. This speed range only was considered, because it corresponded to the actual rate at which the drill would be run in practice.

The most surprising thing about testing drills is the accuracy attainable in the penetration test. If the same man always be employed in feeding the drill through the plate, and precautions be taken to keep all other factors constant, the time of drilling can certainly be found to within two or three seconds per minute. This has been repeatedly proved by submitting drills for test with secretly-altered reference numbers. An accuracy of five per cent. is quite as much as can be expected in most commercial testings of brake horse-power, since this involves reading the revolutions per minute, and the net load on the brake, each correctly to within 2 1/2 per cent. In consequence of this, most

tachometers are not sufficiently accurate for exact work,, and the speeds should always be obtained by means of a revolution counter.

The practical testing of pneumatic drills is difficult, but the testing of pneumatic hammers for power is even more so. Fig. 14 shows an apparatus used by the author for counting the number of blows per minute. Theoretically it should also give the power of each blow, but so many corrections have to be introduced in order to obtain this that the result is not very reliable. About six or seven years ago a highly-trained mathematician undertook this task, and produced a result. Unfortunately this proved to be altogether too excellent, for it appeared that the energy given out by one blow of the piston exceeded that due to the full pressure of the air acting upon it for the full length of the stroke. The author does not propose therefore leaky-valve is at once recorded in the smaller number of blows delivered by the hammer in a given time.

Three of the curves refer to hammer of the same bore, but of different lengths of stroke. The same handle was employed with each in obtaining these results. It will be seen that as the length of hammer increases the number of strokes per minute decreases. The momentum of the blow, however, must be roughly proportional to the length of stroke. This is not shown on the curves because the spring tension is different in the three cases.

The work required to be done by the light pistons used in some of the best-known chipping-hammers requires material capable of withstanding vibration and shock to an exceptional degree. As an example, a piston weighing 8 oz. now does considerably more work than a piston weighing 14 oz. of an older design. It will therefore be apparent that where no difficulty exists in finding suitable material for the latter, much care must be exercised for the material selected for the former. Each piston should be tested by the Brinnell ball test; but before selecting any new form of material, further tests are required. An ordinary test for the smaller pistons is 60,000 blows from a heavy riveting-hammer; for a special test 500,000 blows or more are used and the piston must show no signs of setting up or fracture.

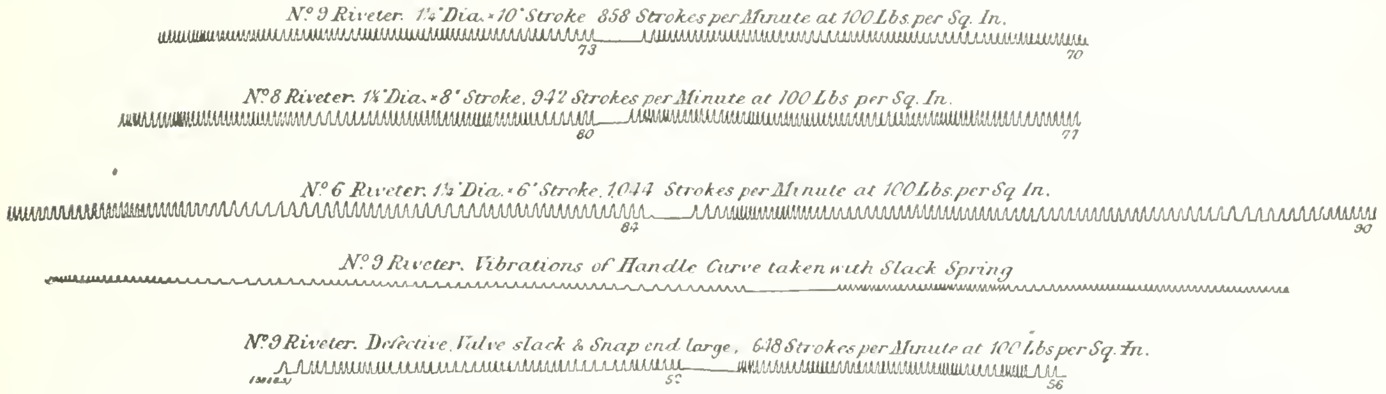


FIG. 15. VARIATIONS OF PNEUMATIC HAMMERS—EACH RUN OF 5 SECONDS DURATION.

to give the somewhat lengthy calculations involved. However, the apparatus is of use in testing pneumatic hammers, as will be seen from the curves Fig. 15.

It consists of a massive cast iron bed provided with T-grooves so that a heavy block may be bolted to it in any desired position. Against this block is placed the handle of the hammer to be tested, resting in a formed recess lined with leather to prevent marking the polished surface of the handle. The snap of the hammer abuts against a heavy block, which can swing about a vertical pivot fixed to the bed. This swinging block is controlled by a spring, which can be adjusted by means of a screwed bolt passing through the fixed abutment. To the swinging block is fixed a light steel arm carrying a stumpy pencil, the point of which rests on a strip of paper which can be reeled by hand off one drum on to another. As the instrument is only required to give the oscillation produced, there is no need to employ a uniform drive for winding the paper. The hammer can be reversed in its support, so as to show the vibrations of the handle. It will be noticed that the effect of a

Conclusions.

Finally, although the production of a perfect pneumatic hammer appears to be more difficult than the production of a perfect pneumatic drilling machine. the author believes that the designs of hammers have reached a point near finality than the designs of drilling-machines. From the preceding observations on the points of efficiencies in the drilling-machines it will be gathered that there is still room for considerable improvements in this direction. There can, however, be no doubt that the reliability of these machines has been immensely improved within the last few years, as the material for each part is now chosen with the most careful analyses of the duties it has to perform, and nothing is left to chance.

ELECTRICITY IN IRON FOUNDRIES.

(Continued from page 228.)

motor. This machine costs about one-fifth as much for power as an air-operated machine of equal capacity.

While any one would expect electricity to be adaptable for power in working metals, it does not seem so likely that it could be used for heat; yet with the ever increasing cost of coal and oil, electricity is beginning to compete with these fuels for the actual heating of metals. There is no means of prophesying how far this will go. At present it is limited or rather refined or special operations where the convenience and cleanliness of electric heat are valuable or where the ease and accuracy of controlling electric heat make it valuable. I believe that a lot of work has been done in using electricity to melt and refine meats, but this application is one over which I shall have to pass as I have no special knowledge on the subject, and I suggest it as an interesting field for those interested to investigate.

Electricity is, however, used for hardening and tempering steel tools. In the hardening furnace there is a bath of barium chloride through which current is passed, and which can be regulated accurately to any temperature as high as 1400 degs. C. Alternating current is required, preferably at 60 cycles. This current is transformed and controlled by a special transformer. The current passes through the bath and keeps it at a uniform temperature thus giving best results on the tools which are to be hardened. The oil tempering bath is merely a pot of oil kept warm by electrically heated resistance units. Both of these devices have proven commercially successful, and I believe show us that many more fields can be entered.

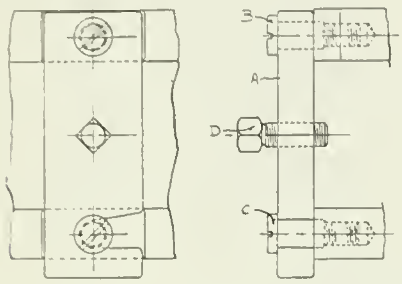
MACHINE SHOP METHODS AND DEVICES

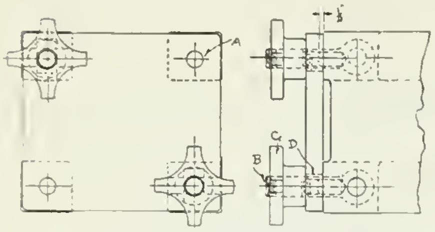
Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

METHODS OF LOCKING JIG COVERS IN PLACE.

By F. Scriber.

WHEN making jigs for interchangeable manufacture it as often as not happens that the best construction for same is to make them in two parts,





FIGS. 1 AND 2. EYEBOLTS AS APPLIED TO LARGE JIG COVER.

namely the body of the jig in which is placed the work, the necessary screws, clamp or bushings that might be required and a cover which may also

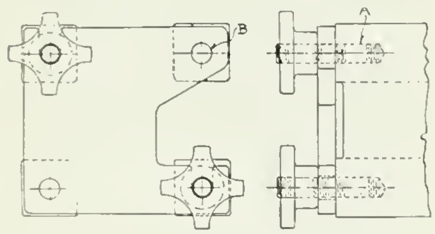
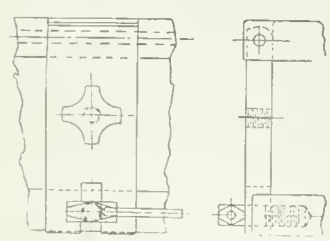


Fig 4



FIGS. 3 AND 4. METHOD OF LOCKING COVER WITH QUARTER-TURN SCREW.

carry screws for clamping and bushings. This cover must be so arranged that it can easily be removed or swung out of the way to permit of the work being removed. The construction should be as simple as possible provided it be rigid and quick operating; this latter depending largely on the number of pieces to be drilled. In the accompanying illustrations it is the purpose to show some of the methods in use for holding or locking these covers in place, and also to give table of proportions which have been found to be good practice for the locking screws and the hand knobs.

Perhaps one of the simplest covers is that shown by Fig. 1 which some might call a clamp, as it is generally used for clamping the work in the jig. It consists of a plate (A) that swings on a stud (B) and is cut out at the opposite end to slip under another stud (C), then, by tightening the screw (D) down,

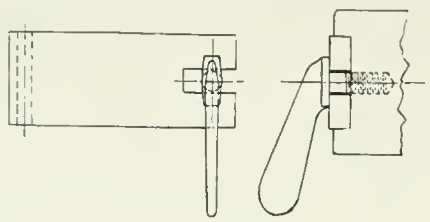
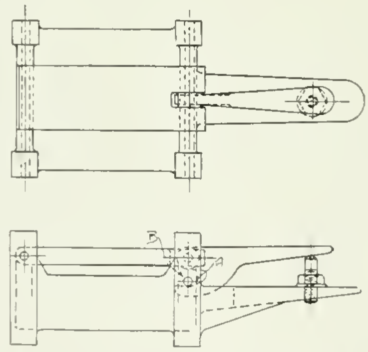


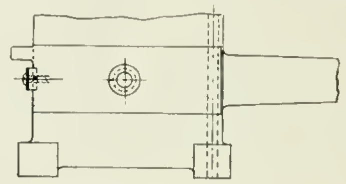
Fig 6



FIGS. 5 AND 6. METHOD OF CLAMPING WITH CAM LATCH.

on the work in the jig, it clamps same. To remove the work we loosen the clamping screw and swing the cover to one side.

Another cover of common design is shown by Fig. 2. This is mostly used on large jigs where the distance between studs would be too great to permit the use of the cover in Fig. 1, or where, owing to there being projections on the cover, it would be impossible to swing it to one side. The construction consists of two dowels (A), which are driven into the base of the jig and are allowed to stand above the top of the latter about 1/4 inch. The cover is dropped over these dowels, thus being accurately located in place. For clamping the cover on the jig, two swinging bolts (B) with hand knobs (C) are swung into the slots (D) and tightened down on the cover. The reason for using swing bolts on this jig is merely for speed in manipulation as it would be necessary



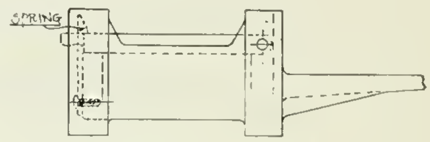
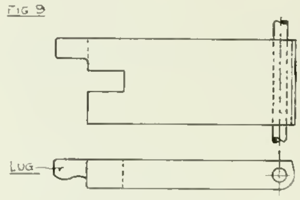


Fig 9



FIGS. 7 AND 9. COVER PROVIDED WITH GRIPPING LUG FOR HANDLING.

to back the hand knobs off the screws if the bolts could not swing out of the way to let the cover lift straight up off the dowels.

When the cover can be moved to one

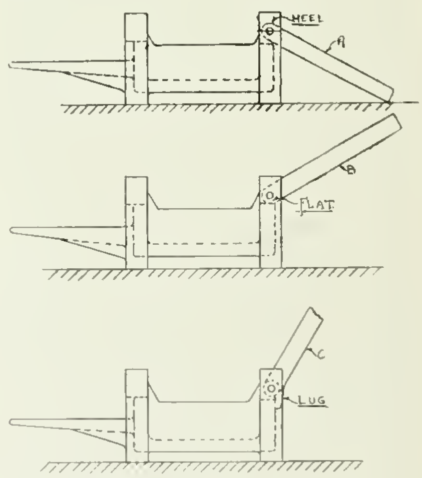


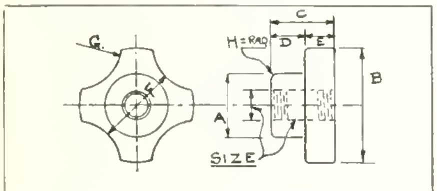
FIG. 8. METHOD OF MAKING HEEL ON COVERS TO PREVENT THEM STRIKING DRILL TABLE.

side on large jigs, it is quite often made as shown by Fig. 3. Plain studs (A), are used with hand knobs for holding them, while the dowels (B) are made to stand above the top of the jig only

1/8 inch. By backing the hand knobs off the screws that much the cover may be lifted off the dowels and moved to one side from under the knobs and off the jig. These last two methods can be used when bushings are carried in the cover, as they are very accurate, although, should there be no desire to do so, the dowels in the cover may be dispensed with. In connection with these covers is shown a table of sizes for the hand knobs used, these being cast to shape and polished.

The remaining forms of covers shown are of the swinging type; all being swung on a pin at one side and bound at the opposite end by various means, of which that shown by Fig. 4 is the most common. A quarter turn locking screw made from bar stock, has a rectangular head, with a pin in the short side which is an aid to turn the screw as required. In use, this screw is made to bind the cover in place when set cross-ways as shown, while a quarter turn brings the head of the screw in line with the slot in the cover, thus permitting the latter to be swung out of the way while removing the work.

Another style of quarter turn screw



SEMI STEEL CASTINGS.

SIZE	5/16-18	3/8-16	1/2-13	9/16-12	5/8-11	3/4-10
A	11/16	7/8	1 1/16	1 3/16	1 1/4	1 1/2
B	1 1/4	1 5/8	2 1/8	2 3/8	2 3/4	3
C	11/16	7/8	1	1 1/16	1 1/4	1 1/4
D	3/8	1/2	5/8	5/8	3/4	3/4
E	5/16	3/8	3/8	7/16	1/2	1/2
F	7/8	1	1 3/16	1 1/2	1 1/2	1 3/4
G	1/2	9/16	5/8	3/4	7/8	1
H	1/16	3/32	3/32	1/8	1/8	1/8

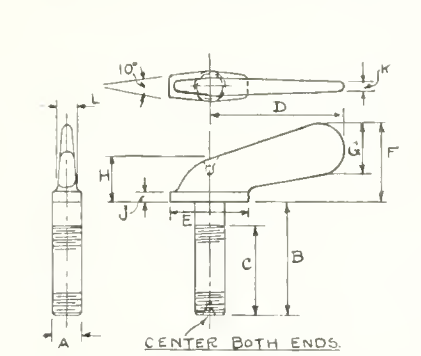
HAND SCREW KNOBS

and one often used by firms who make a large number of jigs is shown by Fig. 5. It is used in the same manner as the previous one, but being required in quantities, is drop-forged.

A good form of lock in general use is of the cam lever type and very quick operating. It differs considerably from the others, the cam latch being pinned to the cover in the manner shown and swinging with same, while for clamping, the slot (A) hooks under a pin (B) in the body of the jig, and as the slot is eccentric, the latch effectively locks the cover in place.

The spring catch shown by Fig. 7 is an example of good practice on jigs of light construction, being simply a spring of the shape shown which hooks over the top of the cover to hold it in place and is sprung off the cover when it is to be swung out of the way to remove the work.

When making jig covers of the swinging type, there are two points which besides the method of locking, it is always best to provide for. The first



A	B	C	D	E	F	G	H
5/16-18	1 1/4	1	1 1/2	3/4	7/8	35/64	7/16
3/8-16	1 1/2	1 1/4	1 23/32	55/64	1	5/8	1/2
7/16-14	1 3/4	1 3/8	1 59/64	31/32	1 1/8	45/64	9/16
1/2-13	2	1 5/8	2 [illegible]/64	1 5/64	1 1/4	25/32	5/8

J	K	L
.140	3/32	7/32
.160	7/64	1/4
.180	1/8	9/32
.200	9/64	5/16

QUARTER TURN LOCK SCREWS

of these is that some means should be provided to prevent the jig cover from swinging too far over and striking the table of the drill press as shown at (A) Fig. 8. Here the heel of the swinging cover is rounded off and therefore permits the cover to swing into the position shown. Were the heel of this cover made like (B) or had it a lug on like (C), Fig 8, the cover would catch on the jig in the manner shown and this be prevented from striking the table of the drill press and damaging it. Again some means must be provided whereby the free end of the cover can be taken hold off and swung back, and unless there are screws or some other projection on the cover which can be taken hold of for this purpose, it is a good plan to provide a lug on the end of the cover as shown by Fig. 9.

The jig covers illustrated in this article show points in construction that are well to have in mind when making up these tools. While they embrace the general run of these covers, they are often adapted in such varying manners that the principles of construction can hardly be recognized.

The John Inglis Co., Toronto, recently shipped to Victoria, B.C., three submarine bells for service in British Columbia waters. The bells, which are the first of their kind to be employed there, were built to the designs and requirements of the Department of Marine and Fisheries, Ottawa.

TENSION ON CYLINDER COVER STUDS.

By J. H. Rodgers.

IN replying to A. E. W. on his solution to the problem of the Tension on Cylinder Cover Studs, I do not wish to enter into any heated argument in support of my solution, but wish to call his attention and also that of others to what, I believe, to be an error in his view of the question. By closer examination of the article in the February 5th issue of **Canadian Machinery** the tension of 1,005 lbs., under correction by A. E. W. will, I think, be found correct.

A. E. W. contends that, after the studs have been elongated 1-1000 of an inch, due to the initial tightening of the nut, an extra weight of 800 lbs. placed on the cover will put no additional stress on the studs, but if a weight of 2,000 lbs. is placed on the cover the studs will be elongated a further 1-1000 of an inch. Surely there has been some mistake in calculation, for why is it, that there is an elongation of 1-1000 of an inch between a weight of 800 lbs. and one of 2,000 lbs., and yet there is no elongation between 0 and 800 lbs.?

C. N. E. ASSOCIATION ANNUAL MEETING.

MANY improvements are to be made at Canada's big fair grounds in the near future. At the annual meeting of the Canadian National Exhibition Association a few days ago, Mr. J. G. Kent, the retiring president, announced that the directors hoped to add very shortly a judging arena that will make the live-stock department the superior of anything on the continent.

He stated that another Government building was one of the requirements of the near future, that plans were under consideration for a more uniform method of housing the manufacturers' exhibits, that a new Machinery Hall was absolutely necessary, that the board hopes it will have been provided in another year or two and that it is proposed to provide a new building for dogs and cats. Referring to the educational exhibits he declared that the time had arrived when they should be placed in a separate building. It was also proposed to devote the horticultural building exclusively to horticulturists.

Mr. Kent said the directors were aiming for an increase of 250,000 in the attendance this year, which means that they would like over 1,250,000 people to see the exhibition. The financial statement was the best in the history of the organization, showing a total revenue of $459,238 and net profits of over $100,000.

NOVA SCOTIA STEEL AND COAL ANNUAL REPORT.

THE annual report of the Nova Scotia Steel & Coal Co. for the year 1913, which was issued a few days ago is in every respect gratifying, and indicates that, in spite of one or two disabilities under which the industry labors, the management is alive and progressive, and is capable of realizing to the fullest extent the content and output of its properties on a remunerative basis.

The earnings of the company, after allowing for depreciation, etc., amounted to $1,255,954, so that, after the bond and debenture interest and preferred dividends were paid, the sum remaining was $668,419, and deducting $368,000 for common dividends, there was left a balance of $308,419. After writing off directors' remuneration, reserve fund for depreciation, sinking fund, plant improvement and insurance, which amounted to a total of $233,132, the balance of $75,287 added to profit and loss account, which now stands at $527,887.

Comparative Output Statement.

	1912 tons	1913 tons
Coal mined	841,528	813,877
Coke made	85,334	104,497
Limestone Dolomite ..	66,315	79,329
Pig-iron made	68,784	80,742
O.H. steel ingots made	77,940	86,912
Steel billets rolled ...	71,284	79,865
Total shipments finished, steel forgings, etc.	77,037	76,963
Wabana ore mines ...	553,373	560,465

The figures as to pig iron and steel are in tons of 2,000 lbs.

DRAUGHTSMEN AND FOUNDRY WORK.*

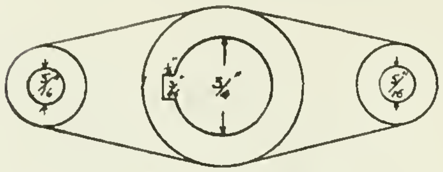
By F. W. Hubble.

IN considering this subject it is found that the average draughtsman takes such a small amount of interest in foundry work that it becomes necessary to consider the point of view that a draughtsman should take rather than the one he does. Quite a number of draughtsmen do not consider the foundry at all, or perhaps only consider it when a bad casting has been turned out; and then perhaps it is only for the purpose of recrimination. From the remarks which are sometimes made, one is induced to conclude that a casting with a high finish and correct to 1/100 in. all over is the ideal thing from the drawing-office point of view. This is, of course, quite impossible in practice, but what should be demanded is a clean, sound casting correctly shaped and within reasonable limits of the drawing sizes. It is impossible to closely define "reasonable limits," as each job must be judged on its own merits.

*From a paper read before the London branch of the British Foundrymen's Association.

Knowledge of Most Meagre Kind.

In the endeavor to cut down pattern-shop and foundry expenses, many people



A CASTING TROUBLE.

overlook the essentials of the matter, and particularly the faults that originate in the drawing-office. The lack of foundry knowledge on the part of the average draughtsman is really appalling. It has been many times proved that a draughtsman who has had a good machine-shop and fitting-shop experience is the man who makes the fewest errors in drawing from the point of view of machining and as a natural result it has become quite usual for head draughtsmen to insist on his assistants having a shop training. But, in no sense of the word can this apply to the foundry practice. Why such an important branch should be overlooked it is difficult to say, but the fact remains; and until it is altered, bad castings will also remain. The remedy is as open as that for overcoming machine and fitting-shops troubles. Why not apply the same treatment in the case of the foundry?

The writer can see no reason why the young draughtsman should not spend, say, one or two years, at least, on the foundry floor. Here he would meet the most common of the moulder's difficulties. As this experience, however, although good in itself, is not enough, it is necessary in order to get expert opinion first-hand to keep in touch with the foundryman, and to invite his criticism of the drawing office designs of castings. In the drawing office big alterations can be made by simply altering a line or so, and at the cost of minutes only, but the case is very different when both the pattern and perhaps the castings too have been made. Alterations then become a matter of days and perhaps weeks, in addition to the waste of time and material.

Unnecessary Casting Troubles.

Mention may now be made of some difficulties with castings which are unwarrantably incurred. The writer experienced one, with the casting shown by the sketch. The pattern was arranged for the keyway, the two 5/16-in. holes, and the 3/4-in. hole to be cored out. The holes and keyway were, of course, to be machined. Here the pattern-maker had put up the cost of the pattern at least 50 per cent. and the moulding cost another 20 per cent. From the machine-shop point of view, the extra labor spent in coring the holes and keyway was valueless, as it was quite impossible to turn out this casting clean in the cores, they being filled, in fact, with a hard mixture of sand and metal, to the great detriment of the drills and slotting tools. Instead of assisting the job, this feature of the design only put up the cost.

Machining Allowances.

Another point is that with regard to machining allowances. On this point many managers will hold out against us. If machining allowances are too small, time is wasted in sharpening tools. With the more expensive metals, such as brass, gun-metal, phosphor-bronze, etc., there is a strong tendency to cut down machining allowances, with the object of saving that amount of metal on each casting, but too often to get this slight saving in weight of metal, first the pattern-maker is given extra trouble with his patterns, because shapes have to be made which in the ordinary way would be machined out of the plain shape; and next the cost of machining goes up because the sand takes the edge off the tool, which must not go deep enough to escape it. Accordingly, the money saved by cutting down the weight is more than lost in the machine or pattern shop, with the net result that the actual cost of the finished article is raised instead of reduced. Again, the number of bad castings will also go up, because there is not enough allowance to take up any variation caused by the slight differences in the position of the cores.

In conclusion, the writer would advocate a better feeling between the shops and the drawing office, with a view to keeping down ultimate costs. If the drawing office won't give this extra time to their designs, then there must inevitably be wasted a lot of time in the pattern shop and the foundry, and unless the patternshop is allowed to be fairly liberal with machining allowances, much valuable time will be lost in the machine shop.

Concrete Hardening Material. — A concrete hardening material now being introduced in the United States contains 95 per cent. iron dust, which is mixed with cement for finishing the surface of concrete floors. From 15 lbs. to 25 lbs. of the material is mixed with 100 lbs. of the cement while dry, and one part of this mixture to two parts of sand makes the slurry for the top coat, which varies from ½ in. to 1 in. in thickness. It is said to make a hard and durable floor, which is waterproof and not slippery. The hardening material is used also to make new concrete adhere to old concrete in repair work.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rogers

Doubtless some of the elementary work in the first few articles of this series may appear more or less superfluous, but it must be remembered that numerous simple rules and formulae appear from time to time in Technical Journals, which are discarded and dubbed impractical by many operators for the simple reason that the elementals are either unknown or have been forgotten. The purpose of this course will have been achieved if the above tendency is even in part combatted.

IN our February 19 issue the introductory details of the arithmetic course were featured, and progress was noted in the instructional work up to and including multiplication of fractions.

Division of Fractions.

Invert the divisor and proceed as in multiplication.

Example:—Divide 2-16 by $\frac{3}{8}$. Inverting the divisor and multiplying, we have

$$\frac{\overset{3}{9} \times 8}{\underset{2}{16} \times 3} = \frac{3}{2} = 1\tfrac{1}{2}$$

Again, $\dfrac{\frac{3}{4} \times 5}{\frac{15}{64}} =$

$$\frac{3 \times 5 \times \overset{16}{64}}{\underset{1}{4} \times 1 \times \underset{3}{15}} = \frac{16}{1} = 16$$

In this case, the product of $\frac{3}{4} \times 5$ is to be divided by 15-64.

Examples of this kind may seem to be wandering from the subject of shop work, but as future problems and formulae will require similar solutions, a paragraph here will be of some help when these subjects are met with.

Decimals.

With the exception of the fractions usually met with on the mechanics' steel rule, that is, quarters, eighths, sixteenths, thirty-seconds, etc., the use—and abuse—of common fractions are becoming extinct in the mechanical trades. The use of decimals has become more general, due to the micrometer and other precision tools of accurate measurement. Decimals are tenth fractions; that is, the decimal, or part of a unit, if expressed as a common fraction would have for its denominator ten or a multiple of ten—as 10, 100, 1,000, etc.

In using decimals, the denominator is understood by the number of places represented in the decimal. To express a part of a whole number decimally, a period (.) called the decimal point, is placed directly after the unit figure, and what would be the numerator of a common fraction is placed to the right of the decimal point. The first figure to the right of the decimal point. The first figure to the right of the decimal point represents tenths; the second hundredths; the third thousandths, etc.; similar to a whole number but reading from right to left. Care must be taken when reading or expressing the value of a decimal that the fractional term (ths.) is used.

When ciphers appear in a decimal, their location has much to do with the value of the expression. Thus, expressing $\frac{1}{2}$ as a decimal, we have .5; but .05 would be 5-100 or 1-20. The value of the decimal is taken from the position of the figures in relation to the decimal point, and not from the figures alone. Chart 4.

Addition of Decimals.

Place the numbers to be added so that the decimal points are directly over each other, and add as in whole numbers. The decimal point in the sum will be directly under the others.

Subtraction of Decimals.

Proceed as in ordinary subtraction, keeping one decimal point directly above the other.

Multiplication of Decimals.

Multiply as in whole numbers regardless of the position of the decimal point. In the product, point off from the right as many places as there are decimal places in the multiplicand and multiplier, adding ciphers if necessary.

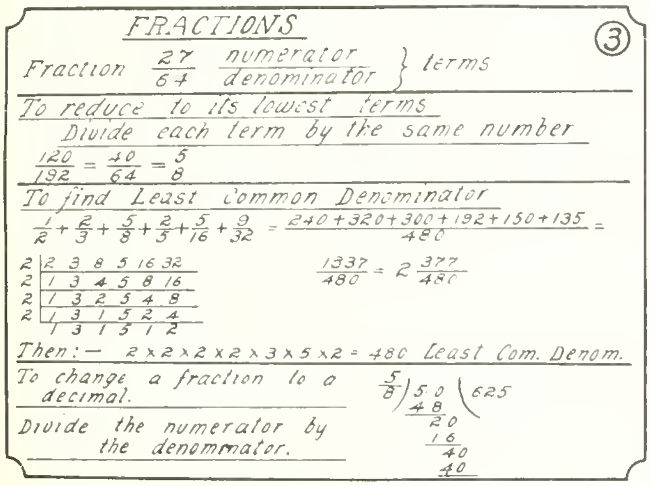
Division of Decimals.

Place the divisor to the left of the dividend. If the divisor is a decimal, cancel or remove the decimal point, and move the decimal point in the dividend to the right an equal number of places; then divide as in whole numbers. Consider the point in the dividend as a figure, and place it in the quotient when met with in the process of the division.

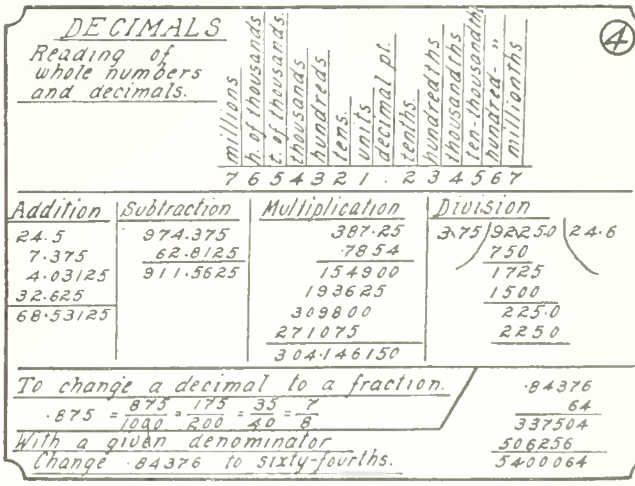
To change a fraction to a decimal annex ciphers to the numerator and divide by the denominator. Point off as many decimal places in the quotient as there are ciphers annexed.

To change a decimal to a fraction. Under the figures of the decimal, place 1 with as many ciphers to its right as there are decimal places in the decimal, and reduce this fraction to its lowest terms.

To change a decimal to a fraction having a given denominator, multiply the decimal by the given denominator. The integral part of the product will be the numerator of the fraction.



ARITHMETIC CHART 3.



ARITHMETIC CHART 4

Percentage.

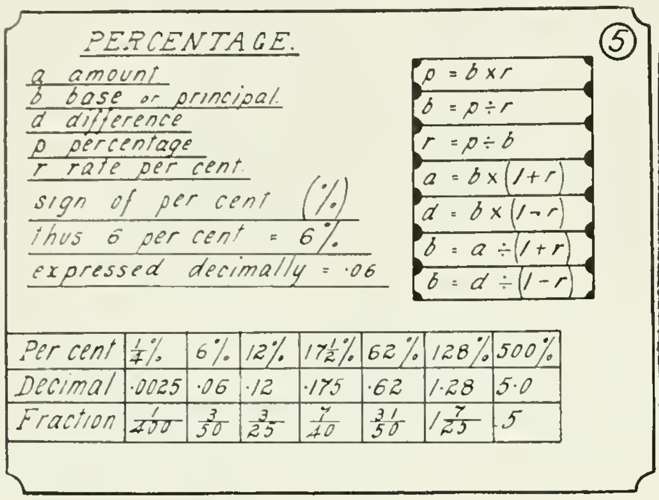
Percentage is the process of calculating by hundredths. The sign of percentage is %, and is read per cent.; thus, 7% reads seven per cent. The different elements used in percentage are:—base, rate per cent., percentage, amount and the difference. The base is the number on which the per cent. is computed; the rate is the number of hundredths of the base to be taken; the percentage is the portion of the base indicated by the rate; the amount is the sum of the base and the percentage, and the difference is the remainder obtained by subtracting the percentage from the base:—(see Chart .5)

To show to what power a number is to be raised, a small figure called an exponent is placed to the right and a little above the number: thus, 4^2=4×4=16, and 12^3=12×12×12=1728.

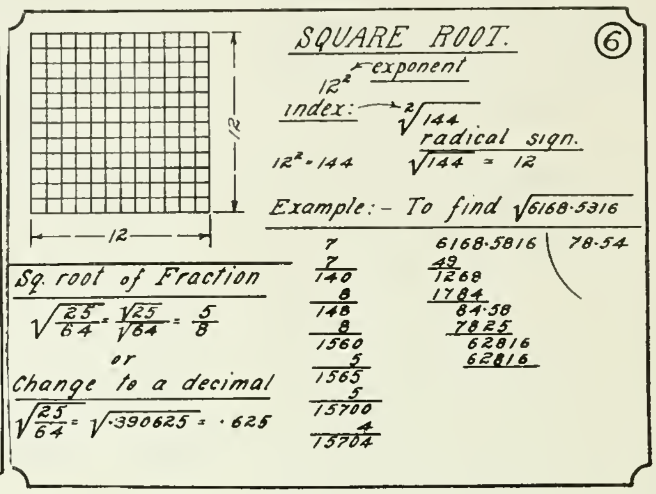
The number being raised to the required power is called a root of that power. To find any power of a number, multiply the number by itself as many times as there are units in the exponent.

Evolution is the reverse of involution, being the process of finding the root of a number which is considered as a power.

The square root of a number is that number which, when multiplied by itself, produces the number. Thus, 9 is the square root of 81, since 9 × 9=81.



ARITHMETIC CHART 5.



ARITHMETIC CHART 6.

Example:—The output of a certain factory was 275 cars a year; by the introduction of new machinery, the increase in production was 18%. What was the new output?

Here, the 275 is the base; the rate 18% expressed in hundreths is 18/100 or .18; the percentage of increase is the base × rate, or 275 × .18=49.50.

The amount or new output would be the base, 275 + the percentage or increase, 49.50; or, by direct formula, the amount=base × (1+rate), or new output = 275 × (1+.18)=275 × 1.18=324.50.

Involution and Evolution.

This section which is much used and almost indispensable in the solution of many mathematical problems, although apparently quite difficult when first studied dissolves itself, like most others, into an application of the four elementary principles of arithmetic:—addition, subtraction, multiplication and division.

The product obtained by multiplying a number by itself is called a power of that number. This process is called involution. Example, 3 × 3=9, then 9 is the second power of 3, and the third power of 3=3×3×3=27.

The cube root of a number is that number which, when multiplied by itself three times produces the number. Thus, 4 is the cube root of 64, since 4×4×4=64.

The radical sign √ when placed before a number, indicates that some root of the number is to be taken, and, to indicate what root is required, a small figure, called the index, is placed to the left and above the radical sign. Thus,

$\sqrt{16}$ denotes sq. root of 16.

$\sqrt[3]{343}$ denotes cube root of 343.

$\sqrt[4]{27.42}$ denotes fourth root of 27.42.

Square Root.

To extract the square root of a number, see Chart 6.

Example:—To find $\sqrt{121104}$.

Begin at the units place, and separate the number into periods of two figures each. Thus 12, 11, 04.

Find the greatest number whose square is contained in the first or left hand period; write this figure as the first figure in the root, also write it to the left of the given number. Thus,

3 12, 11, 04 3.

Multiply this number at the left by the first figure of the root, and subtract the result from the first period, then annex the second period to the remainder. Thus,

```
3     12, 11, 04     3
       9
       —
       311
```

Add the first figure of the root to the number in the first column on the left, and annex a cipher to the result. This is the trial divisor. Divide the dividend by the trial divisor for the second figure in the root and add this figure to the trial divisor to form the complete divisor. Multiply the complete divisor by the second figure of the root, and subtract the result from the dividend. If this result be larger than the dividend, a smaller number must be used for the second figure of the root. Annex the third period to the last remainder for a new dividend. Add the second figure of the root to the complete divisor, and annex a cipher for a new trial divisor. Thus,

```
3     12, 11, 04     34
3      9
—      —
60     311
 4     256
—      ——
64      5504
 4
——
680
```

Continue in this manner to the last period.

```
3     12, 11, 04     348.
3      9
—      —
60     311
 4     256
—      ——
64      5504
 4      5504
——      ——
680
  8
——
688
```

Then $\sqrt{121104}$ = 348.

DEVELOPMENTS IN MACHINERY

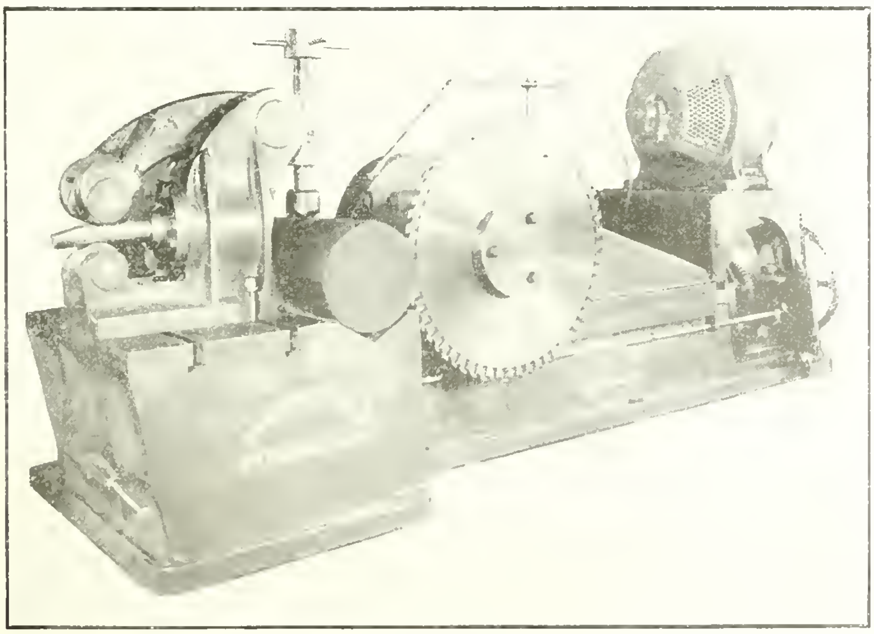
A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

HEAVY TYPE COLD SAW CUTTING OFF MACHINE.

THE illustration and text refer to a recent production of the Espen-Lucas Machine Works, Philadelphia, Pa. This consists of a new heavy duty, rapid production cold saw cutting off machine, carrying a blade 60 inches in diameter, and having a capacity for sawing round or square bars up to 20 inches in diameter. The feed and speed variations are such that the saw can, if necessary, be fed forward at the rate of 6 inches per minute.

The drive is through a main shaft, with a phosphor bronze worm wheel and crucible steel worm running in oil. The spindle extends the entire width of the carriage, and the saw blade is bolted directly against the driving gear, insuring rigidity and avoiding torsional strains between the driving gear and the blade. The feed is obtained from a geared friction plate controlled by an automatic lock nut lever, by which any change in cutting speed can be made while the machine is in operation. The saw carriage also has a quick return controlled by the same lever. An automatic stop for controlling the travel of the carriage is also provided. With this machine any type of saw blade, including the inserted teeth blade or solid high-speed steel types, may be used. Plain screw clamps or pneumatic clamps are supplied with the machine, according to the customer's requirements; and for rapid handling of stock, where multiple cuts are to be made, the machine is equipped with a stock feed attachment capable of handling bars of any length up to twenty feet.

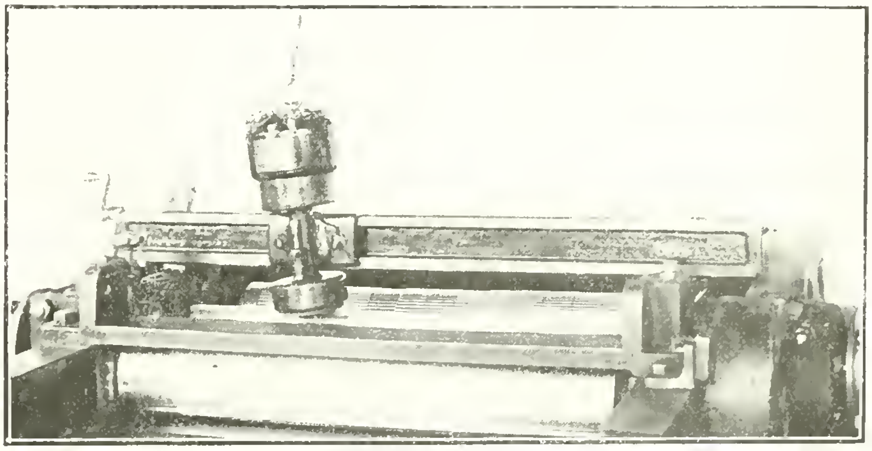
The usual drip pan, as furnished on machines for sawing smaller stock, has been omitted, and in its place a reservoir in the foundation has been substituted. The machine is belt-driven by a 35 h.p. motor, and weighs about 50,000 pounds.



HEAVY TYPE COLD SAW CUTTING-OFF MACHINE

KNIFE GRINDER.

THE need for a machine that will quickly and accurately grind the knives of planers and jointers without the trouble of taking the knives off the machine, has for some time been recognized by users of wood-working machinery. The time spent in removing knives and putting them back properly adjusted is a difficult and unsatisfactory task. The work is often done hurriedly and improperly, resulting not only in poor work, but inefficiency in production. This is especially true of the thin, hard knives used on modern cylindrical head planers which it is almost impossible to grind on an automatic, and reset in perfect alignment the entire length of head. The requirements of a knife grinder are:—That it must grind true; be adaptable to all makes and sizes of planers; be easily attached, and be light enough to be easily carried from machine to machine. In the "Quicsharp" grinder all these requirements, it is claimed, have been combined.



GRINDER ON SURFACER

The "Quicsharp" grinder is motor driven, the motor being mounted in grinder head. Current is taken from an ordinary lamp socket. To the saddle is attached a split nut engaging the feed screw which lays along the top of bridge. The saddle can be fed the length of the bridge in either direction and at any speed desired. The bridge is supported at the ends, or any point most convenient by two angular brackets which are bolted to the jointer bed, holding the grinder perfectly rigid. The grinding wheel which is cup-faced, can be raised or lowered by a thumb-screw and can be set to grind the required amount from knives, automatically feeding itself to a positive stop. In the grinding wheel is a tension spring which maintains a constant and uniform pressure on the grinding wheel, but never too much, thus

eliminating all danger of overheating and burning the knives. The grinder head is pivoted at the centre and can be tilted to either side of the perpendicular. It is held in place against a stop giving the same angle on either side. The tilted head gives a concaved grind to the knives. A positive stop holds each knife in exactly the same relative position to the wheel; therefore, each knife must be ground true to the bed. One illustration shows the "Quiesharp"

GRINDER ON JOINTER.

grinder attached to a B. D. Whitney & Son surfacer. When used on a surfacer, the angular brackets are reversed, being held in place by fixed pins located in the frame of the planer. These pins fit into holes in the foot of the bracket. Adjustments having once been made for each machine, it is only necessary when using the grinder to place it in position on the supporting pins.

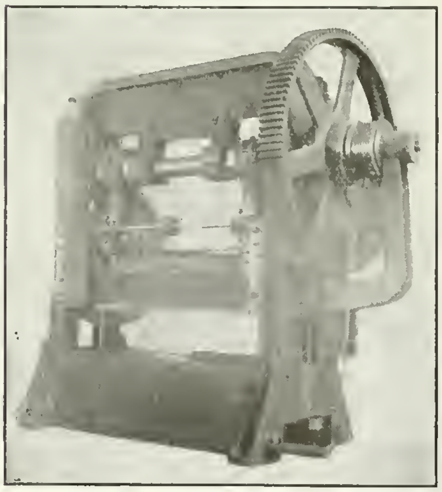
A summary of some of the features and advantages of the "Quiesharp" grinder are as follows: — A pair of knives once put on a machine are never taken off until worn out. Harder knives can be used than is possible with the old method of whetting knives with a file and oil stone. The knives are always in perfect alignment with the bed and with each other, making each knife do its share of the cutting, thus insuring smooth and accurate work. With cylindrical head planers, the knives are so thin and pliable that it is very difficult to grind them on an automatic and put them back on the machine in perfect alignment. A great deal of time is used up adjusting knives. With the "Quiesharp" grinder, knives are ground to a razor-edge right on the machine in five to ten minutes, where it is usual for an operator to spend one-half to three-quarters of an hour, two or three times a day. With a "Quiesharp" grinder, there is no excuse for idle machines. If a nail or gravel stone is run into, usually, instead of having to take off the knives and adjust a new pair, a few minutes with the grinder will clean up the gap and get work started again without any serious delay. Machines will take care of from 25 to 40 per cent. more work than with the file and oil stone method. In the shop where the grinder was first used, four buzz planers, it is stated, are now doing the work with ease, that required five before its use, and with a reduction of one-half in the cost of knives. If one man takes charge of the grinding of knives, using the grinder once a day, the knives will be in better shape than the most expert operator could otherwise keep them. The care and adjustment of knives is a most important part in the operation of planers.

The "Quiesharp" grinder is manufactured by the Stockbridge Machine Co., Worcester, Mass., who also make the Stockbridge Patented Two-piece Crank Shaper.

LARGE DOUBLE CRANK PRESS.

A LARGE double crank press, built by the Niagara Machine & Tool Works, Buffalo, N.Y., embodying the latest improvements in press design, is shown in the accompanying illustration. The press is intended for punching and forming operations for steel car work, but is also suitable for a wide range of heavy stamping operations.

The bed, housings and arch are held together by means of four steel tie rods $4\frac{1}{2}$ in. diameter, which are shrunk in place. The slide and gibs have the same convenience for adjusting as all large presses built by the firm. The motion of the press is controlled by a hand



LARGE DOUBLE CRANK PRESS.

lever operating a powerful jaw clutch. The working surfaces of the three jaws of gear hub, as well as clutch collar, are faced with hardened tool steel pieces. An automatic device is provided to stop the slide at the highest point of the stroke. The press measures 84 in. between the housings, and weighs about 50,000 lbs.

TWIST DRILL MANUFACTURE.

WHAT is claimed to be a revolutionary development in the manufacture of twist drills is the new process inaugurated by the Wilt Twist Drill Co. of Walkerville, Ont. Heretofore it has been necessary to put the drill through half a dozen or more different machining and hand processes in the course of its manufacture, and, while it has unquestionably been possible to produce an extremely good type of drill in this way, the Wilt Company claim a still higher degree of perfection for the drill made by their new method.

The Wilt process is automatic. It applies the principle of the automatic screw machine developed to a high degree to the manufacture of drills, and does at a single chucking the work that under the old process required a number of separate chuckings. The carbon or high-speed steel is fed into the automatic machine in the form of a long rod; the rod is cut off at the proper length for the drill; the end of this rod is grasped by the chuck; a series of roughing cuts brings the grooves of the drill down to within fifteen one-thousandths of an inch of its completed state, and the finishing cut completes the process. The relieving cuts are then made and the drill is released from the chuck, a finished product excepting the hardening, polishing and grinding.

It is claimed for this process that it insures absolute accuracy and uniformity. The grooves are determined with scientific precision, and the clearance is clean cut and well defined. The hardening is done in electric furnaces, in which the heat is effectively regulated. Nothing is left to chance or guess work, every drill being hardened to the exact degree which best adapts it to the work that it is intended to do. Testing and inspection are features which also have close attention.

The plant in which these drills are made is new throughout, built of steel and concrete, and is equipped with the most modern devices for economical and efficient manufacture. The Wilt drills are now being placed on the market, and are, we understand, meeting with a favorable reception wherever they have been introduced.

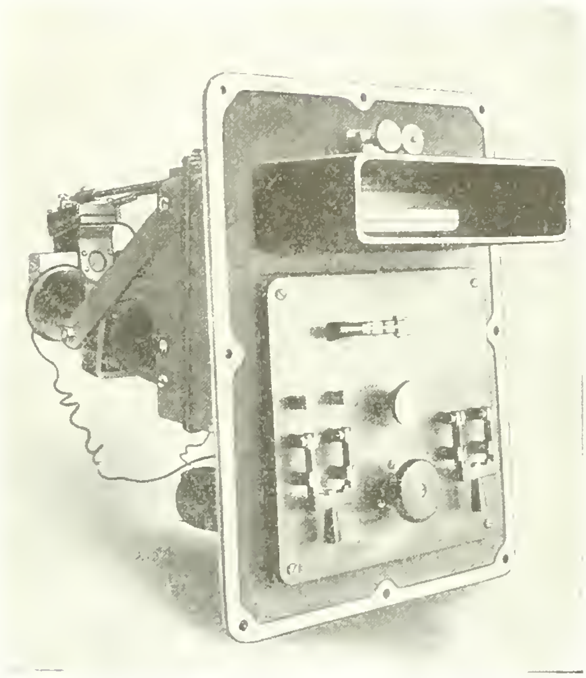
M. P. Fennell, acting secretary-treasurer of the Montreal Harbor Board, has left to join Chairman W. G. Ross in Europe, where they will study harbor conditions.

NEW TYPE VOLTMETER.

IN the testing of insulated wires and cables designed for a great variety of purposes, a voltmeter as we have known it heretofore, often fails to measure adequately the stresses to which the dielectric is subjected. Based on the integration of the sine wave—on the square root of the mean square of instantaneous values — voltmeter readings give little or no indication of unusual peaks in the voltage wave or of surges in the circuit.

The need of an instrument which would give such readings arose in connection with the high voltage testing of wires and cables, it being well-known that, in such tests, the peak of the wave is what counts in breaking down the insulation. So long as a sine wave is maintained, the ordinary voltmeter indicates the peak voltage—a definite percentage above the voltmeter reading, but in cable testing, there is a considerable charging current, due to the electro-static capacity of the cable. As this current is likely to distort the wave form, the ordinary voltmeter may give no definite information as to peak voltage.

After trying and discarding both a spark gap, which proved to be too easily affected by outside conditions, and an oscillograph, which is too delicate an instrument for factory use, the engineers of the Simplex Wire & Cable Co., Boston, proceeded to develop for their own use apparatus which would give the required results. Based upon the principle of the oscillograph, but with its movement confined to a straight line, the new instrument, illustrated herewith, indicates the peak of the voltage wave in its original crude state was used successfully in the Simplex factory for some time, and thus thoroughly tested out. It has just been completed in its present form, after an experimental period extending over two years.



FRONT VIEW—SIMPLEX PEAK VOLTAGE METER SHOWING CONTROL BOARD AND SCALE.

The voltmeter, which is of switchboard type, measures about 10 by 12 in. on the front and 14 in. deep. It consists essentially of a heavy electromagnet, between the poles of which is located the vibrator. By a suitable arrangement of lamp, mirror and lenses, a beam of light is thrown on a ground glass scale in front, graduated in volts. at the limit of oscillation along that line. It does not show the character of the wave or the form of its peak, but it does give very clearly the reading for that peak, whatever the shape of the wave may be. This peak voltage meter, This instrument is connected, through a potential transformer, directly on the high voltage circuit, the current being so small that the apparatus can be left in the circuit all the time. It can be quickly calibrated at any time by applying direct current of known voltage.

This interesting example of the development of an invention to meet a particular factory need might prove of considerable value in other lines as well as that of the manufacture of insulated wires and cables, but its principal indication is the readiness of the American manufacturer to undertake both the deep study and the careful experimental work needed to provide him with the tools with which his regular work can be carried on to best advantage.

REAR VIEW—SIMPLEX PEAK VOLTAGE METER, SHOWING DETAILS OF CONSTRUCTION.

GENERAL CONSTRUCTION OF NEW METER

D. W. Wright, manager of Gunn's, Limited, has been recommended for the position of manager of the new Toronto civic abattoir. The Board of Control has approved the appointment, and the salary named is $3,500.

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Vol. XI. MARCH 5, 1914 No. 10

PRINCIPAL CONTENTS.

IS MATERIAL SUCCESS THE GOAL?

SUCCESS as generally understood is for the most part and has been in all time associated with the acquirement and accumulation of things material, and, of course, failure of necessity implies the lack of these.

"The man who succeeds at thirty is often a failure at forty," says a writer, and to show that the claim to be called successful at thirty is based on material acquirement, the writer goes on to say that "there may be observed a great many men in business around the age of thirty who have made considerable money, who own an automobile, and have acquired a certain amount of what we style the world's goods." We do not dispute the fact that, measured by wealth or worldly possessions or both, the experience is a common one, and, even when tested by a standard of worth higher than tin or tinsel, there is no lack of examples of men who have also deteriorated in the moral sphere, between these ages. Notwithstanding the latter, however, the inference that success means tucking away ducats loses nothing of its force and reality.

Again, would the transition from implied affluence at thirty to some state or condition of existence at forty where the term affluence if suggested, would unhesitatingly be dubbed sarcasm, of necessity constitute failure? Unreservedly no, and dare we dogmatise as materialistic and unregenerate writers are so prone to do, and conclude that any man so circumstanced is less of a success at forty than at thirty. We trow not. Wealth or worldly possessions do not make the man, whether those have been his birthright or whether his own efforts have been instrumental in harvesting them, and no superficially applied title of success or failure in the respective circumstances and embracing, if you like, a century of years instead of only ten years will alter this basic and all-important Christian principle.

To quote further from the same writer, we are informed that "the principle that the man who doesn't succeed is the man who deserves to fail is dawning in the eastern sky," and that "if we do not rise above a mere job, a mere daily wage, etc., we have nobody to blame but ourselves." For downright egotism, impudence and presumption we challenge the pages of history and literature for a parallel to the above, and were it not for the fact that through the series of writings from which these extracts have been taken, other more or less contradictory and unwarrantable statements are made, and all ostensibly, mark you, for the elevation of the toiler in every sphere of labor and enterprise, a grave importance might easily be attached to and disastrous results ensue from the broadcasting of such unwholesome teaching. It happens, however, there is evident disorder in the brain box from which this type of teaching emanates, not dissimilar in effect to the striking mechanism of a cheap clock when some tangle in its wheel train causes it to ring three when the dial indicates and the hour in reality is four.

As an indication of the above condition, we quote the following query and reply, from the same source as the others. Someone is represented as saying, "what of the man who worked hard, who believed in himself and went down to failure." Well, "out of failure and out of mistakes a man's strength really comes." There is here sufficient indication of an application of the requirement and training of the individual life, and were those whose temperament is so constituted that it does not seem to them to matter whether the clock is striking the right hour so long as it strikes, to take counsel with themselves, take themselves to task and refrain from dictating to others concerning the fundamentals of their being, of which, after all, they are by no means so ignorant as they get credit for, or if, in other words, "everybody kept their own doorstep clean, the whole street would be clean," there would be a considerable and widespread increase in the output of effort towards the general uplift and well-being.

Failures, as we said a week ago, are the stepping stones to success, and we are almost certainly to have been mistaken in our judgment that the man with cash, automobile and real estate at thirty had secured the latter, and just as certainly in error that the same man at forty without these was a failure. Material measurement of men is the curse of our time, yet character and performance of duty as we know how, are and will continue to be in demand, when real work has to be done and achievement small and great is needful of accomplishment.

INDUSTRIAL NOTABILITIES--No. 24

JAMES FRATER TAYLOR, president of the Lake Superior Corporation, Sault Ste. Marie, Ont., is the son of Alexander and Mary (Frater) Taylor. He was born at Aberdeen, Scotland, on March 23, 1873, and was educated in the public schools of that city.

His first important undertaking was in 1902, when he took an active part in the reorganization of the electric railway system at Madras, India. His connection with Canada began in 1909 when he was appointed third vice-president of the Lake Superior Corporation and director of a number of the subsidiary companies. At the same time he took in hand the reorganization of the corporation on behalf of financial interests principally in London, England. The more important subsidiary companies at that time were, and still are, the Algoma Steel Corporation, the Algoma Central Railway and the Algoma Eastern Railway. The Algoma Steel Corporation at that time had a capacity of 500 tons of pig iron per day and a rail mill capable of producing about 700 tons of rails per day, with two furnaces to take care of the entire output. The Algoma Central at that time was badly handicapped by having no proper outlet; being more or less incomplete and having inadequate terminal facilities. During the past five years

JAMES FRATER TAYLOR

the development of the Lake Superior Corporation and subsidiary companies has been proceeded with. The plant of the Algoma Steel Corporation has been enlarged and has now a capacity of 1,000 tons of pig iron per day. New open-hearth furnaces have been built and rail mills remodeled, the result being an increased output to 1,200 tons of rails per day. A large and up-to-date power plant has been installed and coke ovens built to obviate the necessity of importing that material. The Algoma Central will shortly be in operation as far as the junction point with the Canadian Northern Ontario Railway, and later will connect up with the Grand Trunk Pacific Railway. Rapid progress is also being made in the construction of the Algoma Eastern Railway from Sudbury. The terminals have been equipped with large ore and coal docks.

In October, 1913, Mr. Taylor was made president of the Lake Superior Corporation and of the various subsidiary companies, being also on the Board of the Lake Superior Paper Company.

Mr. Taylor, in 1898, married Frances Alice Hill, daughter of Joseph Hill. They have one son and two daughters, and live at Sault Ste. Marie, Ont.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3....	19 50	20 00
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3.......	19 50	20 00
Clarence, No. 3........	19 50	20 00
Jarrow	.....	23 50
Glengarnock	......	26 00
Summerlee, No. 3......	22 00	.....
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1........	19 00	18 35
Victoria, No. 2X.......	18 75	18 10
Victoria No. 2 Plain...	18 50	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh.........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal......	2.10
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh.....	1.20
Steel hoops, Pittsburgh..........	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ in., 100 lbs...	$2 30	$2 20
Heads, per 100 lbs.......	2 55	2 55
Tank plates, 3-16 in......	2 60	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	9 00	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate Washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb off
Nuts, Hexagon, all sizes..	4½ per lb off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright	85, 10, 7½, 10, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, bronze	70, 10, 7½, 10 p.c. off

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in...	75%
Finished Nuts over 1 in....	72%
Semi-Fin. Nuts up to 1 in..	72%
Semi-Fin. Nuts over 1 in...	72%
Studs....................	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings..	9 00	9 00
No. 1 wrought iron.....	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	13 00	12 00
New brass clippings....	8 50	8 75
No. 1 brass turnings....	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$. 32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	.....	.....	.....
10 in	3.50	....	.....	.....	.....
10 in	4.12	....	.....	.....	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in. ..	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$16 00	$15 75
Electrolytic copper	15 75	15 25
Casting copper	15 00	15 00
Spelter	5 25	5 25
Tin	41 00	42 00
Lead	5 15	5 30
Antimony	8 50	8 50
Aluminum	21 00	19 00

SHEETS.

	Montreal.	Toronto.
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4.30	4.10
Queen's Head, 28 B.W.G.	4.40	4.20
Fleur-de-Lis, B.W.G.	4.20	4.20
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.40	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal.	0.22
Pure turpentine	0.69
Linseed oil, raw	0.60
Linseed oil, boiled	0.63
Plaster of Paris, per bbl	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., March 2, 1914.—Salesmen report little improvement in trade over last week, cautious buying being still the rule in almost all lines. The dullness of trade is strongly evidenced by the shrinkage in railway earnings and by the reduced banking and Customs clearings. The report of the C.P.R. for January, recently issued, shows a decrease in net earnings of 39 per cent., as compared with January, 1913. The earnings for that month, however, were much above the average, owing to favorable weather, combined with activity in all branches of commerce. Perhaps a surer test may be found in the Customs returns for Montreal, which for the month just closed show a decrease of $362,662, as compared with the returns for the same month last year. However, an improved state of affairs may doubtless be looked for in the course of a month or two from now.

The general opinion appears to be that 1914 will be a year of fair prosperity for manufacturers. There is not likely to be much done in the way of plant extensions, and in many cases manufacturing methods are likely to be carefully revised with a view to reducing unit costs and effecting all possible economies.

The present position of Dominion Steel stock bears witness to the weak state of the Canadian steel industry at present. Steel interests in the United States, however, expect a revival of buying orders this month. The present lack of business is largely attributable to the want of railroad orders; so that a general resumption of business that will increase railroad earnings should bring about a marked improvement in steel conditions.

There has been a fair buying movement in pig iron during the past week or two. Inquiries, however, have been mostly for second half delivery, and, since the recent advance in prices by American and Canadian furnaces, sellers are not very willing to accept contracts for second half delivery.

Copper remains at last week's prices, but there is little doing. A revision of prices downwards may be expected shortly in electrolytic, following a reduction in New York. Tin is back to the figure it stood at about a month ago; but this metal is subject to a great deal of market manipulation at present, and, though immediate prospects are for a continuance of comparatively low prices, the London syndicate may decide otherwise.

Toronto, Ont, March 3, 1914.—Generally speaking, the condition of the market shows no change over last week, prices as a rule remaining firm. From what we hear substantial improvement is not expected to take place just yet. The structural steel business is quiet, and will remain so until the weather shows signs of moderating and building activity becomes more pronounced. Reports from the United States show that the mills are increasing their output, and that the improvement is expected to be maintained. This is an encouraging reminder of the gradually improving conditions in the steel business in the States, and indicates what may be expected to take place in Canada later. The Steel Company of Canada state that they find business very fair, with distinct signs of improvement. They report no change in prices. A structural steel concern in Hamilton state that they anticipate an improvement in trade, and they consider prospects are looking brighter.

Dealers in machine tools consider that the market generally is quiet, but that prospects are improving. A number of small orders have been booked, but no large specifications appear to be in sight. The Canadian Buffalo Forge Co. are buying equipment for their new plant at Berlin, Ont., an order for two electric traveling cranes having been placed here. A local firm have recently sold some "V. & O." presses to a new company starting up at Hamilton, and also to the National Cash Register Co. for their new Toronto plant. The motor boat show at the local Exhibition Grounds seems to have been a decided success. One firm exhibiting marine engines state that a number of inquiries have been received, and that prospects look bright for the coming season. The Polson Ironworks have been busy all this winter, and will be having several launches during the immediately coming months, the first taking place this week. Their yard is full up with work, and they have in addition several nice contracts coming along.

The tool steel and mill supply business shows a little improvement, although no substantial increase in the volume of business can be reported.

The metal market is quiet, a fair number of small orders are being booked, but no heavy buying is taking place. Prices are stationary, being the same as last week.

SUBMERGED FIRING.

In the Zeitschrift fur Dampfkessel und Maschinenbetrieb, recently, Privy Councillor Jaeger gives an account of the Brunler system of submerged firing. He points out that hitherto the construction of steam boilers has been based on the heat produced by the processes of combustion being conducted to the fluid in the boiler through its walls. This system involves very considerable losses both of heat and material. The Brunler "Greek fire" method of submerged firing is at first sight startling, but Mr. Jaeger describes the Brunler boiler which has been used with great success by the Wesenfeld, Dicke & Co., chemical factory at Dahl, near Langerfeld. The boiler plant consists of a cast steel generator in which the flame burns under the surface of the liquid, and of a cast iron collector or the liquid, the steam, and the gaseous products of combustion. The fuel used is coal tar oil.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Rainy Lake, Ont.—The M. & M. A. Deans Co., are moving their hub factory to Sprucedale, Ont.

Weyburn, Sask.—The Acton & Montgomery Co., are in the market for an oxy-acetylene welding plant.

Toronto, Ont.—The Polson Ironworks are in the market for a doubled-ended punch, a 5-ton locomotive crane and a number of light air tools.

Brantford, Ont.—The Waterous Engine Co. has been granted a six months' rebate of taxes on certain property, on recommendation of the assessors.

Fort William, Ont.—The Canada Iron Foundry are very busy now, a full staff of workmen being employed full time. Orders for cast iron pipe for Fort William, Edmonton, Moose Jaw and Swift Current are in hand.

Galt, Ont.—The Shurley-Dietrich Co. has its handle factory in full operation, and all hands belonging to the plant destroyed by fire have been given employment of one kind or another. The company plans resuming operations on a larger scale, but when and where has not yet been disclosed.

Dundas, Ont.—The Dickson Building Co. has purchased the old Maw & McFarlane foundry from Alex. Galbraith, and will completely remodel the entire structure. The north side of the building has been leased to the Dominion Mineral Water Co., of Toronto, who will manufacture mineral waters on a large scale.

Ford, Ont. — A. N. Lawrence, sales manager of the Ford Motor Co., of Canada, Ltd., reports that Tuesday, Feb. 24, was a record day for the automobile factory at Ford. On that day the Ford plant built 105 cars and shipped 129. This is the largest production and the greatest activity for any one day in the history of the Canadian plant.

Sarnia, Ont.—The Mueller Mfg. Co., of Sarnia, has increased its capital from $300,000 to half a million. The rapid growth of the business justified the increase, and this spring it is planned to make a considerable increase in the number of men employed. New machiney, costing $20,000, will be installed, such as lathes, moulding machines, steam hammers, etc., and it is understood that other building extensions will be made to the plant.

Collingwood, Ont.—By a vote of 712 to 259 the ratepayers of Collingwood voted on Feb. 24 in favor of a by-law authorizing the town to guarantee the bonds of the Imperial Steel and Wire Co. to the amount of $10,000. The company in question will extend its works by the erection of a wood screw factory, which will give employment to 120 men in addition to the 200 already employed in the wire works. Colonel Currie, M.P., is the president of the company.

Montreal, Que.—A formal notice has been issued confirming the recent announcement that the Northern Electric Co., Ltd., has acquired the business and undertakings of the Imperial Wire and Cable Co., Ltd., and the Northern Electric & Mfg. Co., Ltd, subsidiaries of the Bell Telephone Co., of Canada. The officers of the new company are E. F. Sise, president; Paul F. Size, vice-president and general manager; Clement Sare, secretary, and G. W. Jones, treasurer.

Electrical

Runnymede, Ont. — It is considered highly probable that the hydro-electric will be here this summer.

Dundas, Ont.—The townships of Ancaster and Beverley are asking the Ontario Hydro Commission to extend their power lines to these districts.

Weston, Ont.—A petition signed by a large number of ratepayers will be sent to the Ontario Hydro-electric Commission, asking for the service to be extended to the district east of this village.

Vineland, Ont. — The hydro-electric meeting, held at Vineland recently, was addressed by Engineer Purcell, who explained to the ratepayers of Clinton township the terms upon which the Ontario Commission will furnish power to the municipality.

Toronto, Ont.—The towns of Listowel, Chesley, Harriston, Wiarton, Clifford and Mount Forest want hydro-electric. The engineers are looking into the matter as to the advisability of obtaining current from Eugenia Falls in the Owen Sound district, or from Niagara Falls.

Windsor, Ont.—The first step in the purchase of the Walkerville Light and Power Co. by the Hydro Commission was taken when Hydro Commissioner Hatcher interviewed Mr. Murphy, manager of the Light and Power Co., for the purpose of having an inventory taken and presented to the commission for consideration.

Halifax, N.S.—Halifax has a lively hope of soon getting cheap electric power. The Nova Scotia Power Co. now developing Gaspe expect to be able to generate 15,000 horse-power, and run a distribution wire to Halifax. There is a power company to develop electric power from the Mersey, and another on the St. Margaret's River. With the question of cheap power solved, Halifax would have a great many advantages as a manufacturing centre, having the benefits of cheap water freights for the importation of raw materials.

Municipal

Oak Ridges, Ont.—$8,000 for a new school building, passed.

Coquitlam, B.C.—$35,000 as a temporary loan, passed by council.

Strathroy, Ont.—$25,000 for a Hydro-Electric system, carried by electorate.

Windsor, Ont.— An incinerator will probably be installed here in the near future.

Edmonton, Alta.—The city is contemplating the purchase of steel garbage wagons.

Tilbury, Ont.—$10,000 for a Hydro-Electric system and $6,000 for waterworks extension, passed by council.

Vancouver, B.C.—The city has decided to appoint an industrial commissioner Applications should be in by March 2nd.

Sarnia, Ont. — Application will be made to the Provincial Legislature for powers to enable Sarnia to be created a city.

Collingwood, Ont.—$100,000 to guarantee the bonds of the Imperial Steel and Wire Company, carried by ratepayers.

Sarnia, Ont.—The town council have decided to purchase a steam road roller and a concrete mixer at an estimated cost of $3,500.

Sarnia, Ont.—The Sarnia Steam Railway have formulated plans to extend their tracks farther south to the Mueller Mfg. Co.'s plant.

Port Arthur, Ont.—The plans for the proposed water works and sewer construction have been approved by the Provincial Board of Health.

Chatham, Ont.—The city council are again considering the advisability of buying out the Chatham Gas Company. A by-law will probably be voted on.

St. Marys, Ont.—The Water, Light and Heat Board of St. Marys have decided to purchase a graphic meter, at a cost of $350, to check up the hydro readings.

Simcoe, Ont.—The town is considering the question of installing a sewage disposal plant and a complete system of sewers. The estimated cost will be about $200,000.

Sherbrooke, Que.—An active advertising campaign will be conducted with a view of making this town better known as an industrial centre. The town council and Board of Trade are working together.

Winnipeg, Man.—Contracts aggregating approximately one quarter of a million dollars, and covering much of the preliminary work in the Greater Winnipeg water project have been let by the administration board.

Toronto, Ont.—It is estimated that $100,000 will be required for new fire-fighting equipment, which will include ten combination chemical and hose wagons, a hook and ladder truck, two tractors for aerial trucks, and six automobiles for district chiefs.

Shedden, Ont.—A large gathering of ratepayers of Shedden met in Morrison's hall on Feb. 26, to consider the matter of natural gas. The chair was occupied by G. G. Hopkins, and L. B. Morse acted as secretary of the meeting.

Estevan, Sask.—The following by-laws have been carried:—$30,000 for the erection and equipment of a hospital; $69,000 for extensions to the sanitary sewer system; $27,000 to extend the waterworks system; $10,200 for construction of mechanical filter and filter house.

Ottawa, Ont.—City Engineer Currie has presented a report to the city council for an alternative scheme to the proposed water supply from Thirty-one Mile Lake. The new scheme provides for a mechanical filtration plant and reservoir, the estimated cost being $53,000.

Hamilton, Ont.—A number of big works to be proceeded with this year include a power plant for the Dominion Power & Transmission Co. to cost $1,000,000; harbor dredging and general work, $500,000; McKittrick syndicate bridge, $140,000.

Dundas, Ont.—The town is contemplating installing a sewage disposal plant. A committee has been appointed to secure a site and appoint an engineer to prepare plans and estimates. J. F. Armour, consulting engineer, is being retained in an advisory capacity.

Melville, Sask.—Applications will be received by the town clerk until 6 p.m., Monday, March 16th, 1914, for the position of Engineer for the Town of Melville. Applications will please give details of experience in sewage installation and other branches of work, and state salary required.

Toronto, Ont.—The immediate erection of two temporary incinerators, one on the Western Cattle Market annex property, and the other on a site to be provided by the removal of the Street Cleaning Department's present shops at the eastern yards, is advocated by Street Commissioner Geo. B. Wilson in a report presented to the City Works Committee. The total estimated cost of the two incinerators is $74,504.

Toronto, Ont.—Fire destroyed a five-storey building at 579 Richmond Street West on February 26. The firms affected by the fire are—Long & Co., $80,000; Independent Cloak Co., $30,000; Beaver Shirt Co., $20,000; Monarch Clothing Co., $30,000; L. Freifield & Co., $15,000; loss on building, $65,000.

Windsor, Ont.—Ratepayers of the city voted on March 3 to sanction by-laws which will give exemptions to three new industries. The Central Ice and Cold Storage Company proposes to erect a plant with a daily capacity of fifty tons of ice, which will cost in the neighborhood of $150,000. The other two companies seeking to open offices here are the Dowsley Spring & Axle Co. and the Ideal Concrete Machinery Co.

Ingersoll, Ont.—The Ingersoll Gas & Light Co., are busy preparing for the delivery of natural gas in Ingersoll within the time prescribed by the agreement three weeks. Two of their representatives, Messrs. Doherty and R. Wright, are canvassing the town and ascertaining from consumers of gas what changes they will require made in their gas stoves. So soon as the facts are ascertained, the actual changes will immediately follow.

West Lorne, Ont.—A special meeting of the Village Council was held on Feb. 25, for the purpose of considering the by-law and agreement with the Southern Ontario Gas Co. F. B. Thomb, of the latter, and Town Solicitor J. S. Robertson were present. A provisional by-law was passed, and as soon as approved by the votes of the people, West Lorne will be supplied with natural gas. The rate is said to be low, and the agreement is satisfactory to the council.

Montreal, Que.—It is stated that the question of granting a forty-year franchise to the Montreal Tramways Company will be placed before the ratepayers in the form of a referendum at the forthcoming municipal elections. It was indicated that the fact of the elections taking place just six weeks from now made it imperative that the citizens should have a say in the matter as to whether the Tramways Corporation was to receive an addition of thirty-two years to its present franchise, which expires in 1922.

Montreal, Que. — Tenders are being called for fifteen 5-ton and two 3-ton trucks and five runabouts or roadsters. The tenders will be opened on March 5. The Roads Department will have the 5-ton trucks, while the water department will have the 3-ton trucks for carrying pipes, etc. Of the runabouts, three are for officials of the water department and two for the fire department. Additional to the auto trucks the roads department will also purchase this year auto sprinkler-sweepers and auto vacuum street cleaners, the latter being used to pick up rubbish on paved streets.

Chatham, Ont.—As a result of a conference with the city council, the following concessions were settled upon, to offer prospective industries. Exemption from taxes not to exceed ten years. A fixed assessment not to exceed ten years. All assistance possible in the securing of a site. If a concern wishes to take advantage of the borrowing powers of the city in the shape of a loan, the city will, after becoming satisfied as to the financial standing of the concern, advance $1,000 for every $3,000 put into the plant and the city's portion shall not be paid over until the investment is made by the company.

Stratford, Ont.—The citizens of Stratford, by overwhelming majorities, voted in favor of three industrial by-laws which were placed before them. The Morlock by-law, which grants a $2,500 site to the John Morlock Upholstering Co. of Hanover, and fixes the assessment at $7,500, was carried by 1,550 votes to 121. Another by-law, which gives a $3,500 site and a fixed assessment of $7,500 to the Diebel Furniture Frame Co., also of Hanover, went through by 1,557 for and 114 against. The third by-law fixes the assessment on the Stratford Manufacturing Co. at $7,500, and won out by 1,584 to 87.

General Industrial

Vancouver, B.C. — Bettschen & Higgins will build a boiler house.

Vancouver, B.C. The British Columbia Sugar Refinery Co. will erect a two-storey factory to cost $2,500.

Guelph, Ont.—A Chicago firm, manufacturing counters and showcases, will locate their Canadian factory in Guelph.

Chatham, Ont.—It is planned to submit a by-law for granting a bonus to the Concrete Products Co. A previous by-law was defeated.

Brampton, Ont. The Lindus Co., Ltd., are asking the town for a loan of $20,000 for a term of 15 years. They propose to erect a factory costing $50,000.

Maple Creek, Sask. — The Canadian Hunt Mfg. Co., have selected a site for their new factory and preparations will shortly be made for building.

Kingston, Ont.—The Board of Trade have received an application from a company desiring to locate here. No details are being given out at present.

Welland, Ont.—A Hamilton, Ont., company are preparing to build a brick and tile factory here. A site has been purchased of about nine acres.

Sidney, N.S.—W. A. Winfield is interested in a company who are proposing to establish a plant for distilling and bottling water for drinking purposes.

Regina, Sask.—The Western Tire & Rubber Co. will build a factory here, 300 x 60 ft. It is stated that $175,000 will be spent on buildings and equipment.

Lindsay, Ont. —The Cole-Berger Co., will probably build a new factory this spring. The town has loaned the company $12,800 towards the purchase of new machinery.

Windsor, Ont.—J. T. Wing & Co., Detroit, Mich., manufacturers of factory supplies, will build a plant here. The building will be 100 x 100 ft., and three storeys high.

Owen Sound, Ont.—It is understood that a company is proposing to buy the match factory here and equip a plant for manufacturing chemicals. Mr. William Campbell is interested.

London, Ont.—The London & Petrolia Barrel Co., which has been incorporated, will continue to enlarge its plant each year, although no extensive improvements are expected this season.

Ingersoll, Ont. — The Southern Ontario Gas. Co. contemplate installing a natural gas system. The town council have sanctioned the scheme. Mr. Lowery is general manager of the company.

Brampton, Ont.—The town council is considering the request of the Copeland-Chatterson Co., for a loan of $40,000 without interest as a bonus for a new factory which they propose building.

Bridgeburg, Ont.—The plant of the Canada Foundry Co. here was closed Tuesday and Wednesday last week on account of difficulty in obtaining sufficient gas supply with which to operate.

Regina, Sask.—Leitch Bros., Oak Lake, Man., will erect a 3,000-barrel flour mill, a 300,000-bushel elevator, a 200-bag oatmeal plant and a cooperage and bag factory here. The buildings to be erected will cost $300,000.

London, Ont.—Five thousand dollars' damage was done to the stock of the Dominion Meter Co., by a fire, said to have been caused by an attempt to thaw out some pipes with a gasoline torch. The loss is covered by insurance.

St. Catharines, Ont.—On account of the Consumers' Rubber Co., by-law being defeated, the city council have authorized the industrial commissioner to reopen negotiations with the company with a view to inducing them to locate here.

Niagara Falls, Ont.—The Automatic Parcel Checking Co., will probably build a factory here if the citizens will interest themselves to the extent of $10,000. No concessions are asked except the usual terms given to manufacturers for power and water.

Waterford, Ont. — The Universal Chemical & Electrical Co., have purchased an existing factory building here and will manufacture telephones, electrical fixtures and electrical sundries. Brantford capital is interested and Albert T. Jacobs is general manager.

Medicine Hat, Alta. — The Carlyle Creamery Co., of this city, according to W. M. Henderson, the manager, will erect a large plant as soon as building operations open in the spring. A large pasteurizing plant, fully equipped in every detail, will be installed.

Welland, Ont.—Steel is now being delivered on the Electric Steel and Metals Co.'s site, and the erectors, the Standard Steel Construction Co., will begin construction work the latter part of this week. Contractor Gardner will start brickwork as soon as steel work is completed.

Fingal, Ont.—J. D. and Wm. Davis intend building a large addition to their evaporating factory. This buisiness has grown so that the present building is inadequate to accommodate the supply of apples brought in, and the addition will be commenced as soon as the weather is warmer.

Winnipeg, Man. —It is understood that the Austin Paper Co., of this city, is having plans prepared by the Albertson Engineering Co., Kalamazoo, Mich., and Toronto, Ont., for the erection of a board mill, which will use flax straw for the making of board, and that construction will go ahead this spring.

Hamilton, Ont.—The Willys-Overland Co. of Toledo, automobile manufacturers, who recently purchased the old Jackson Typewriter building in Sanford Avenue, when it decided to establish its Canadian branch in Hamilton, is arranging for large extensions. Plans have been prepared for a new building, 210 by 65 feet, and three storeys high. Work will begin at once.

Perth, Ont.—The electors of Newboro will vote on a by-law on March 16 to decide the question of bonusing the Ontario Milling & Manufacturing Co., who intend re-opening the canning factory. A bonus of $200 per year for 10 years is contemplated, with the usual fixed assessment, etc. Seventy-five hands will be employed for at least six months in the year.

Vancouver, B.C.—The contract for the Hudson's Bay Co.'s department store in Victoria has been awarded to the B.C. Construction and Engineering Co. The work of construction will be commenced within a few days. The contract price has not been announced, but it is between $700,000 and $800,000, exclusive of the cost of excavation, and also the mechanical equipment.

Victoria, B.C. — An order-in-council was passed on February 21, authorizing immediate purchase of Lang's Cove drydock site at Esquimalt. This decisive step confirms previous predictions as to Victoria being the premier shipbuilding port and naval base on the Canadian Pacific Coast. The next step of the department will be to rush the preparation of plans and specifications and call for tenders.

Vancouver, B.C. — The James M. Davidson Fisheries, of Edinburgh, Scotland, will erect a fertilizer plant on the Skeena River, British Columbia. At present the canneries on the river make no use of the refuse of their plants, and representatives of this firm have entered into contracts with these canneries for the sale of their offal. The machinery is to be shipped from Scotland, and it is expected that the completed plant will cost in the neighborhood of $100,000.

Swift Current, Sask.—Owing to the increased demand for their product, the Swift Current Cement Products Co. will increase the capacity of their plant at once. The building will be enlarged and much new machinery installed, among the latter being machinery for the manu-

facture of cement sewer tile. In addition to the cement blocks and sewer tile, cement fence posts and ornamental columns will be manufactured. The company will employ twenty-five men when the changes are made.

Melfort, Sask.—A new grain company has been formed at Melfort, Sask., for the encouragement of the grain industry in the Carrot River Valley. The company is capitalized at $200,000. It is proposed to erect a number of elevators in the district, and it is also possible that a flour and cereal mill may be erected if it be found that the supply of grain justifies the establishment of this industry. A number of the citizens of Melfort are backing the new scheme, and the grain company with good management is expected to prove one of the leading assets of the district.

Sarnia, Ont.—A large number of boilermakers are now at work on the Imperial Oil Co.'s plant placing several new crude stills in position on the river side of the refinery. In all about ten of these new stills are under way, and it is expected that more will be put up as soon as possible. At all parts of the plant a great amount of new work is being done, and it is expected that as soon as the weather sets in fine more men will be added to the force. The new acid house, near the Pere Marquette roundhouse, is about completed, with the exception of a few details. Work about the motor spirits plant is being pushed along rapidly.

Refrigeration

Harriston, Ont.—The large cold storage building of the William Davies Co. has been temporarily closed. It is announced that business will be abandoned at this plant until the arrival of hydro power.

Fort Francis, Ont.—The York Manufacturing Co., York, Pa., recently installed a 4-ton vertical, single-acting, belt-driven enclosed type refrigerating machine, and high pressure side complete, in the Fort Francis Hotel here.

Medicine Hat, Alta.—President Pearson of the Medicine Hat Pure Ice Co., and Mr. Davidson of the same concern, are completing arrangements with the city for a site for their ice plant. It is understood that the site has been secured and without doubt an agreement will be entered into at once. The plant will be one of the largest of its kind, and the firm are contemplating the building of a large skating rink and curling rink in addition to the ice making plant. It is their intention to have the plant completed in time for the summer ice trade.

Railways-Bridges

Paris, Ont.—The Lake Erie & Northern Railway have laid their tracks within the limits of the town.

Brantford, Ont.—A by-law will be introduced this week at the city council meeting for the purchase of the Brantford Street Railway.

Port Arthur, Ont.—The city is to apply to the legislature immediately for the extension of its street railway into the townships of McIntyre, Goreham and Ware.

Toronto, Ont.—The councils of the counties of York and Ontario have decided to build two bridges to cost $7,000. The bridges will have a span of 40 feet and be constructed of steel and concrete.

Chatham, Ont.—As the result of a gas explosion in the generating plant of the Chatham, Wallaceburg and Lake Erie Electric Railway three men were seriously injured and the frame boiler room was completely wrecked, leaving the five boilers exposed to the elements.

Brantford, Ont.—The Lake Erie and Northern Railway will make application for the increase of its bonding power from $30,000 per mile to $45,000 per mile. The application will come before the railway committee of the House of Commons, but the city will not be a party in any way.

Ottawa, Ont.—In the Private Bills Committee, sitting on February 24, the bill of the Niagara-Welland Power Co. was considered. This company is asking a charter to dispose of the power that will be developed by the building of a new Welland Canal.

Vancouver, B.C. — The date for the closing of tenders for the construction of the Second Narrows bridge is fixed for April 1. It is understood five big contracting firms in Vancouver will compete for the construction of the bridge, and that a number of tenders will be received from firms in Eastern Canada.

Montreal, Que.—It is stated here that the Canadian Northern will have its western terminals at Calgary. Report also says that the Great Northern, which is about to construct a line into Alberta, may agree with the Canadian Northern to have a union station at Calgary. In any case, it is said, the Great Northern's depot will be on the east side.

Petrolea, Ont.—At a recent meeting of the town council a deputation to represent Petrolea at the hydro radial convention on March 5, was appointed, consisting of Mayor R. Stirrett, Reeve Dr. C. O. Fairbanks, Deputy Reeve Burgess and J. C. Waddell, chairman of the fire, water and light committee.

Ottawa, Ont.—It is announced that a commission will be appointed to inquire into the commercial feasibility of the Georgian Bay Canal. The names of the commissioners have not been made public, but it is thought that Sanford Evans, of Winnipeg; Col. F. Meighen and Edward Gohier, of Montreal, will be appointed.

Ottawa, Ont.—A holding company with a capital of $10,000,000 to be known as the Ottawa Traction Co. has been formed to take over the stock of the Ottawa Electric Railway Co. It is proposed that three shares of stock in the new company shall be issued in exchange for every one share of Ottawa Electric Railway.

Melbourne, Ont.—Residents are in favor of routing the proposed London-to-Glencoe hydro radial line this way, and it is probable that deputation from Melbourne will ask the councils of Caradoc and Ekfrid to use their influence in that behalf. It is desired that the line will run from Delaware along the Longwood road to this place and continue to Glencoe.

London, Ont.—Hydro engineers are already going over the route of the London and Port Stanley Railway in connection with the electrification scheme. The matter of other radials in the district hooking up with the city's road will also be looked into. The line from Aylmer has been surveyed, and it has been found that, in view of the level country, the bulk of construction work will be reasonable.

Victoria, B.C.—Bonds of the Canadian Northern Pacific Railway to the further amount of $5,110,000 are to be guaranteed by the Province of British Columbia, a bill for the purpose having been introduced in the legislature by the premier. This will make a total of $47,950,000 of Canadian Northern bonds guaranteed by the Province, with probably some more to be announced in the near future.

St. Thomas, Ont.—Representatives of St. Thomas, Aylmer, Yarmouth, and Malahide met here to consider a proposal to guaranteed the bonds of the London & Lake Erie Transportation Co. for an extension of the radial line from St. Thomas to Aylmer, and from Union to Sparta. It was agreed to guarantee the bonds to the extent of $20,000 a mile, but there is a difference as to apportioning the amount to be borne by the municipalities.

ASSOCIATION AND PERSONAL

A Weekly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Machinery Circles

Personal

N. C. Peterson, of Sarnia, died there, aged 80, on February 24. Mr. Peterson was in the foundry business for many years.

A. F. McCallum, city engineer of Hamilton, Ont., has left for Key West, Fla., where he will spend a vacation of two weeks.

Fred. Mitchell has resigned his position with the Otis-Fensom Elevator Co., Hamilton, after being with them over twelve years.

O. B. Mueller, of the H. Mueller Manufacturing Co., has returned to Sarnia, Ont., from New York, where he had been on a business trip.

F. W. Wanklyn, C.E., former controller of the City of Montreal, and assistant to the president, C.P.R., was 54 years old on February 25.

Capt. J. D. Macpherson, wreck commissioner, has returned to Victoria from Vancouver, after holding an investigation into the loss of the steamer Vadso.

F. Ross Newman, resident manager in Toronto of the Canadian Fairbanks-Morse Co., Ltd., has returned from Europe, having been away about six weeks.

D. B. McCoy, formerly chief clerk of the Steel Company of Canada at Belleville, Ont., has been appointed traveling salesman for the same organization, with his headquarters in Belleville as formerly.

E. C. Stokes, of Hamilton, Ont., has been recommended for the position of street commissioner for the Town of Woodstock, Ont., at a salary of $1,200 per annum.

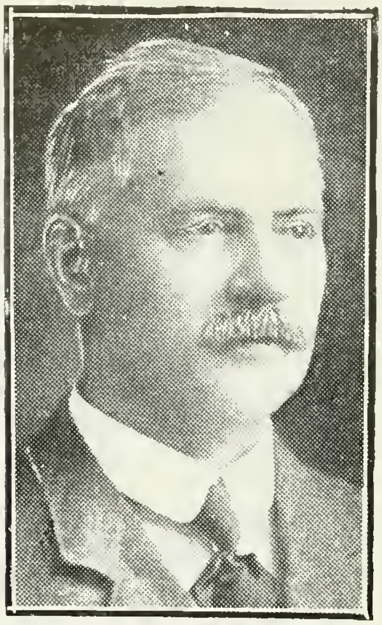
Ferdinand de Lesseps' Statute.— The "Matin," Paris, states that Myron Herrick, the United States Ambassador to France, has asked the U.S. Government to erect a statue of Ferdinand de Lesseps at the entrance to the Panama Canal.

E. H. Bennett, of Chicago, the town planning expert, has been engaged to prepare plans for the City of Ottawa, working under authority from the Government. Mr. Bennet made similar plans for Chicago and other large cities.

R. Winslow has been engaged by the Board of Harbor Commissioners, Vancouver, as harbor engineer, and will be retained in that capacity for the present to look after the drafting of plans and other work of a general nature in connection with the harbor.

J. H. Plummer, president of the Dominion Iron and Steel Co., does not seem to be perturbed over the fact that business is very dull. Telegrams come to him respecting orders wherever he goes. He wears a confident smile, seeing, as he does, considerable sunshine behind the present clouds.

G. M. Kennedy, factory superintendent of the Massey-Harris Co.'s works on King Street West, died at his residence, 466 Indian Road, on February 27, where he had been confined for a week with pneumonia. The late Mr. Kennedy was born in Blenheim Township fifty years ago, but moved to Woodstock later, where he was employed with Patterson Bros., coming to Toronto in 1885. He is survived by his wife, one daughter and one son. He was for some years foreman, then assistant superintendent of the Massey-Harris works, and was appointed superintendent about five years ago. Mr. Kennedy was considered by his employers to have had exceptional exectuive ability, and was very popular with the men. His death, which came unexpectedly in the prime of life, is keenly felt by the directors and officials of the company.



THE LATE G. M. KENNEDY.

Herbert S. Holcroft, D.S.L., of Toronto, has left for Fort Churchill, on the Hudson's Bay. He will go via Winnipeg and Le Pas, Man. As a Dominion Government official, Mr. Holcroft is going north to lay out a townsite at Churchill, as it is now called, under the supervision of the Department of the Interior.

P. A. Galarnean has just resigned his position with J. H. Gignac & Co., with which firm he had been connected for fifteen years, to take up the position of general manager of the Citadel Brick and Paving Block Co., Quebec, made vacant by the death of the late Mr. Fred Thorn.

Vancouver, B.C.—Davis & Leslie, consulting engineers, 119 Pender Street West, have been appointed harbor engineers to lay out the North Arm of the Fraser River by the North Fraser Harbor Commissioners. The engineers will begin their work just as soon as the funds voted by the municipalities concerned are available.

Athol Davies, the stationary engineer who was badly burned when an explosion of natural gas occurred on Tuesday morning, February 24, and wrecked the boiler-room at the generating plant of the Chatham, Wallaceburg and Lake Erie Railway, Chatham, Ont., died at St. Joseph's Hospital on February 27. John Montague and William Roberts, firemen, who were also injured, are progressing favorably, and will recover.

The Polson Ironworks will build two 24-in. suction dredges for the Canadian Stewart Co. for work on the Toronto Harbor improvements. The dredges will be 170 ft. long, 42 ft. beam, and 12 ft. deep. They will be each equipped with four 400 h.p. Babcock & Wilcox semi-marine type boilers, and 1,500 h.p. triple expansion engines, driving a centrifugal pump. The engines will be supplied by the New York Shipbuilding Co., Camden, N.J.

A. O. Backert, editor of "The Foundry" and general manager of The Penton Publishing Co., Cleveland, Ohio, has accepted the position of secretary-treasurer of the American Foundrymen's Association, which was tendered him shortly after the resignation of Dr. Richard Moldenke, on January 17. Mr. Backert will enter upon his duties as soon as Dr. Moldenke completes the current volume of transactions, which work he is now bringing to a close.

Tenders

Toronto, Ont.—Tenders for transformers will be received by the Toronto Hydro-electric System up to March 12,

Winnipeg, Man.—Tenders will be received until March 23, for the supply and delivery at Lac Du Bonnet station of one steam locomotive complete with tender and snow plough. Specifications and form of tender may be obtained from the office of the city light and power department, King street, Winnipeg.

Ottawa, Ont.—Sealed tenders, addressed to L. K. Jones, secretary Dept. of Railways, and marked "Tender for Section No. 2, Severn Division, Trent Canal," will be received until 12 o'clock noon on Monday, March 23rd, 1914. Plans, specifications and forms of contract to be entered into can be seen at the office of the chief engineer of the Department of Railways and Canals, Ottawa; at the office of the superintendent engineer, Trent Canal, Peterborough; Ont.; and at the office of the district engineer, Public Works Department, Midland, Ont.

Humboldt, Sask.—Sealed tenders will be received by the secretary-treasurer until 8 p.m., Wednesday, April 15, for the following works. (A)—Labor laying water mains and sewers. (B)—Pump house and filter house. (C)—Furnishing material for and erecting water tower. (D)—Furnishing cast iron water pipes. (E)—Furnishing fire hydrants and valves. (F)—Furnishing and installing pressure filters. (G)—Furnishing and installing pumping machinery. (N)—Furnishing wood stave pipe. (O)—Laying wood stave pipe. (P)—Constructing ejector station. (S)—Furnishing sewer pipes. (X)—Constructing sewage disposal works. Plans and specifications may be seen at the office of the engineers, Toronto and Winnipeg, and at the town hall, Humboldt, on and after March 16th. Chipman & Power, engineers, Toronto.

Contracts Awarded

Fort William, Ont.—The city council have decided not to engage an engineer to report on a sewage disposal system.

Winnipeg, Man.—The tender of the Canadian Westinghouse Co. of $16,828 was accepted for the supply and delivery of switching apparatus for the King St. sub-station.

Hamilton, Ont.—The Hamilton Bridge Co. has been awarded the contract for the erection of the McKittrick Bridge, which is to open up the east end of the city. The bridge and approaches will cost $120,000.

Vancouver, B.C.—Grant Smith & Co., and McDonnell, Ltd., two Vancouver firms which tendered jointly for the construction of the new Victoria wharves and docks, have been awarded the contract at $2,244,795.

St. Catharines, Ont.—The Lord and Burnham Company of New York have awarded to The Samuel Austin & Son Co. of Cleveland and Thorold, Ont., the contract for the erection of their new factory building at St. Catharines. The steel work will be done by the Standard Steel Construction Co. of Welland.

Winnipeg Man.—In accordance with the suggestions of the manager of the city light and power department, the council passed the board's recommendations that the single-phase pole type transformers contract be awarded to the Canadian Westinghouse Co. Chapman & Walker, Ltd., were given the the three-phase pole type transformers contract, while the Canadian Maloney Electric Co. was awarded the contract for the single-phase subway transformers.

Catalogues

The Canadian Westinghouse Co., Ltd., Hamilton, Ont., are distributing a leaflet describing the properties and method of operation of their "Ozonizer" apparatus. A complete description is given also of a list of commercial applications.

Steam Pumps are dealt with in Catalogue No. 9 recently issued by the Smart-Turner Machine Co., Ltd., Hamilton, Ont. Several types are illustrated and a brief description given of each.

"Lagonda Cut-off Valves" is the title of an attractive catalogue which has been issued by the Lagonda Mfg. Co., Springfield, O. The valves and other specialties manufactured by the company are illustrated and described fully, the illustrations including views of several installations. Copies of this catalogue may be had by writing.

Automobile Battery Charging is the subject of a folder, 4201-5-13, recently distributed by the Canadian Westinghouse Co., Ltd., Hamilton, Ont. The folder illustrates and describes the Westinghouse Cooper-Hewitt Rectifier Outfits for charging electric automobiles in garages. The last page contains a last of various sizes of battery-charging outfits and accessories.

Canadian Billings & Spencer, Ltd., Welland, Ont., have issued a new catalogue dealing with the extensive line of machine wrenches and tools which they make. Each specialty is illustrated and tables are included, giving the principal dimensions for each size. Illustrations are also shown of various samples of drop-forging work. Copies may be had on request.

Jackson's Utility Vise is dealt with fully in a pamphlet received by us from the Brown Engineering Co., Reading, Pa. The pamphlet states that this vise is suitable for drill presses, millers, shapers, etc., and for die, mould and tool makers. The illustrations show the vise under varying conditions of service. A description is given together with a specification. Copies of this pamphlet may be had by writing.

The Morse Chain Co., Ithaca, N.Y., has issued a pamphlet, No. 12, entitled the "Morse Long-Service Chain Drives." The pamphlet consists of a number of short descriptions of typical "Morse" silent chain drives showing their durability and efficiency for long periods of time. Each installation is illustrated, and a summary is given of all the drives. The pamphlet concludes with particulars regarding the design and operation of the "Morse" chain.

The Niles-Bement-Pond Co., New York, have sent us a copy of their new catalogue dealing with the "Niles" electric traveling cranes. This is a handsome production containing many illustrations of electric cranes operating under various conditions, indicating their wide range of service. The principal constructional features are illustrated and described in a comprehensive manner. The Canadian Fairbanks-Morse Co., Ltd., Toronto, Montreal, etc., are the Canadian sales agents.

Braby's Handbook has been sent us by Frederick Braby & Co., Ltd., London, Eng. This handbook is intended for engineers and those interested in galvanized iron, sheet metal products of all descriptions, and structural steel. The catalogue contains illustrations of various grades of galvanized sheets, many examples of architectural ironwork, steel structures, steel tanks, and interior views of the company's rolling mills at Glasgow, Scotland. Particulars are given of roofing sheets and other products, while the concluding pages contain a number of useful tables. The handbook is indexed and is an attractive, pocket-size publication.

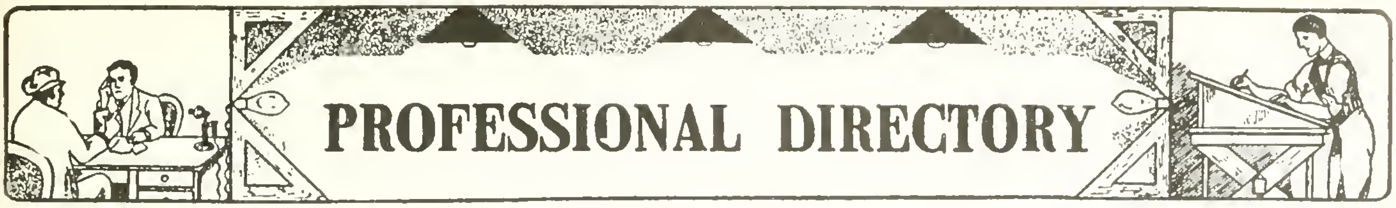
The Canada Machinery Corporation, Ltd., Galt, Ont., have forwarded a number of bulletins covering new designs in wood and metal-working machinery. The bulletins are as follows: No. 504, tenover; No. 303, heavy moulder; No. 1097, 42-in. heavy coach wheel lathe; No. 1103, horizontal punches; No. 1100, 36-in. heavy duty vertical drilling machine; No. 1090, 50-in. rotary planing machine; No. 1096, extra heavy driving wheel lathe; No. 1099, 76-in. portable radial girder drill; No. 1105, all-geared bead lathe; No. 1104, heavy gate shear with turntable; No. 1098, heavy duty double-axle lathe, and No. 1088, 60x60-in. forge planer. Each machine is illustrated and a general description given. Copies mailed on request.

The Industrial Harbor is the title of a very interesting and well-arranged catalogue which we have received from Deutche Maschinenfabrik A. G. (Demag) Duisburg, Germany. The catalogue contains a large number of illustrations of loco cranes, floating cranes and discharge bridges, in fact, views of practically all the lifting and transporting appliances that might be required in any harbor or dock. Views of a patent railroad car dumping appliance are also shown. The illustrations are exceedingly good and are reproduced from photographs taken of the various appliances in operation. The catalogue contains 152 pages, and is well bound with an attractive cover. Copies may be obtained, by interested readers, from the Canadian sales agents, Gerald Lomer, Ltd., Fraser Building, Montreal, Que.

Book Review

A Report on the Bureau of Supplies has been published by the Department of Water, Gas and Electricity Supply of New York City. The report consists of a description of the work done and results accomplished in the reorganization of the Bureau of Supplies during the past two years under the supervision of Elihu C. Church, chief of the bureau, who was appointed by Commissioner Henry S. Thompson. The various systems introduced and procedure adopted are dealt with at length, each main department being treated separately, such as organization and administration, purchasing, inspection, storage and issue, records and accounts. Several charts are included showing the connection between the various departments, procedure charts, orders issued and money spent. There are also a number of illustrations showing interior views of storerooms.

Handbook for Machine Designers and Draftsmen, by Frederick A. Halsey, 494 pages, $8\frac{1}{2}$ x 11 in., 400 illustrations, 120 diagrams and charts, and 400 tables. Published by the McGraw-Hill Book Co., New York. Price $5 net. This is the best book on machine design that we have seen in recent years, and will be invaluable for draftsmen, designers and engineers. The author has had many years' experience in machine design, and was for eighteen years editor of the American Machinist, his experience in that position being responsible for the inspiration which prompted the compilation of this work for, as the author says in the preface, a number of valuable contributions are published in technical journals which after publication are usually never seen again, a great deal of useful data thus being lost. The object of this book is primarily to preserve such contributions as are of direct use to designers of machinery. The book is arranged so that each section begins with a fresh page, and the illustrations and table numbers in each section begin at No. 1, thereby rendering it possible to drop old or introduce new material in future editions. One of the features of this book is the excellence of the diagrams and illustrations, which are fully dimensioned and of such a size that they can be copied direct. Great liberality has been shown in the number of diagrams, illustrations and charts, each subject being well supplied in this respect. The various sections deal successively with materials, mechanisms, machine parts, springs, chains, gearing, bearings, hydraulics, power requirements of machine tools, boilers, compressed air, steam and gas engines, etc. Each subject is treated in a thorough, comprehen-


PROFESSIONAL DIRECTORY

sive, and practical manner, the diagrams and tables, etc., being of great assistance in following the reading matter. Practically all the data required by machine designers and draftsmen has been incorporated, while the concluding fifty pages devoted to mathematical tables help to make the book very complete. This is a desk book and not a pocket book, thus making it possible to include drawings and diagrams sufficiently clear so as to be easily seen and obviating the necessity of folding plates. The reading matter is printed in clear type and the book is bound in substantial cloth covers.

Personal Experiences of Some Modern Methods of Welding*

By Thomas T. Heaton

The facts and figures contained in this article are drawn from the author's personal experiences, for the most part, and cover a period of over twenty years on work relative to welding of a progressive, commercial nature. He expresses the hope that a short, practical survey of the subject will, in view of the increasing interest being shown, be found helpful and instructive.

THE old blacksmith's method of welding by heating in a coke fire and hammering is well known. It is known also to suffer from drawbacks of various kinds. The heat cannot always be regulated as well as could be desired. Impurities are often introduced into the joint. The weld itself is sometimes found to be defective, that is to say, it is not welded throughout, and the defect may be hidden, as there may be an outside weld of no depth. Great skill is therefore necessary with this class of welding. The methods the author proposes to describe are quite different, and for certain classes of work produce far superior results to any that the blacksmith can attain. Often welds can be made which no blacksmith could undertake. Broadly speaking, the systems may be divided as follows:—

(A)—Electric welding, in which the heat required is produced by the electric current.

(B)—Gas welding, in which the heat is produced by a gas or mixture of gases.

These divisions may be subdivided, as in both cases there are variations both in method and in means. In electric welding, the chief variations are as follows:—

(1)—The electric arc, as in the Benardos system and its variants.

(2)—The system invented by Mr. Arthur Strohmenger, and owned by Messrs Slaughter & Co.

(3)—The contact system, as in the Thomson-Houston method, The Pontelec, the Helsby and the Allgemeine Elektricitats Gesellschaft.

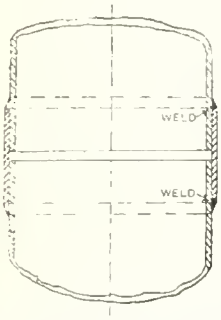


FIG. 1. OUTSIDE BUTT STRAP JOINT FOR AIR RECEIVER AT 100 LBS. PER SQ. INCH.

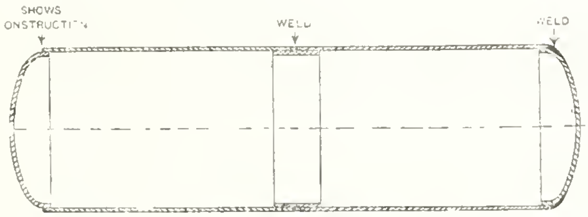


FIG. 2. METHOD OF WELDING ENDS OF VESSEL TO RESIST INTERNAL PRESSURE. ALSO INSIDE BUTT STRAP JOINT.

*From a paper read recently before the Institution of Mechanical Engineers.

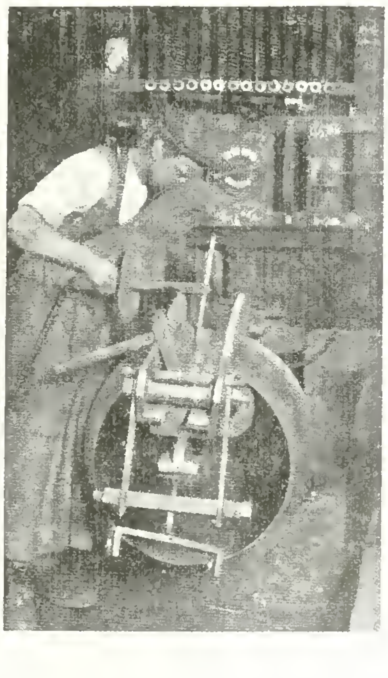


FIG. 4. WELDING BODY OF STEEL BARREL BY ELECTRIC ARC

FIG. 5. WELDING WATER-JACKETED EXHAUST PIPE BY ACETYLENE AND OXYGEN. THREE TYPES OF BURNER SHOWN

FIG. 3. WELDED CYLINDER TESTED TO DESTRUCTION

1.—The Benardos System.

The Benardos System, if properly adapted to the work to be done, and with the plant well designed for generating, distributing and regulating the current, is practical, simple and effective. It demands a direct current of about 90 volts. The quantity of current used depends on the thickness to be welded, and may in ordinary practice range from 200 to 500 amperes. The work itself forms the positive pole of the arc, and a rod of carbon the negative pole. By this arrangement, the greatest amount of heat is in the weld, as the positive pole is the hotter.

Where a number of welders are employed, it is necessary that the current shall be supplied in such a manner that one welder shall not affect the arc of another. This is effected very simply by generating in a compound-wound dynamo of ample capacity; and the machine should be slightly over- rather than under-compounded. By this arrangement, an increase of load does not lower the voltage. In a well-designed machine, the voltage scarcely varies, provided the engine driving it is efficient to maintain its speed. The arcs are arranged in parallel, and each arc

is provided with a regulator to adjust the current to the work to be done. The rod of carbon forming the negative electrode is fastened in an insulated holder of light construction. The workman holds this in his hand, strikes the arc by placing the carbon in contact with the work, and manipulates it so as to spread the arc and heat the work at and near the point to be welded with what is described as a soaking heat. When the welding heat is attained, the work is hammered or not according to circumstances. Screens with colored glass windows are used to protect the eyes and skin of the workman from the effect of violet rays.

FIG 6 ACETYLENE-WELDED WATER-JACKETED EXHAUST PIPE MADE OF STEEL 1-16 IN. THICK.

The Zerener Process.

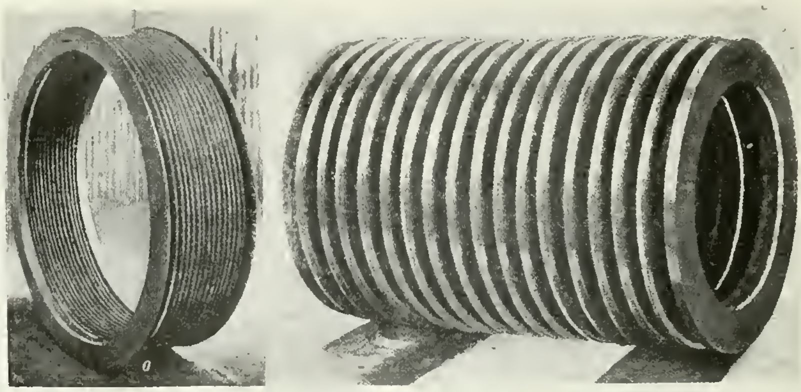
The Zerener Process is an arc-welding system which was introduced by Dr. Zerener of Berlin some twenty years years ago. In this there are two carbons in the same holder, and there is a magnet which deflects the arc produced between these two carbons downward on to the work. No current passes through the work at all. There have been modifications of this system. The object is to maintain a constant voltage in the arc by having a constant length of arc. In the Benardos process the length of arc varies slightly as the workman moves the carbon nearer to or farther from the work. There is, however, in practice, no disadvantage in this.

II.—The Strohmenger-Slaughter System

The Strohmenger-Slaughter System is worked with either direct or alternating current. Alternating is, the author believes, preferred. The voltage is not very high, and its amount, within limits, not important. He has seen 85 volts used with direct, and 220 volts with alternating current, both effective. The quantity of current depends on the work.

FIG 7 ACETYLENE-WELDED NON-JACKETED EXHAUST PIPE.

The parts to be welded are placed in juxtaposition, and an electrode is laid upon and along the welding line. This consists of a soft iron rod covered all over, except at the extreme ends, with a flux which may be constructed chemically to suit the metal to be welded. Contact is made between the work and one end of the electrode, which fuses by a series of arcs along the welding line, melting the electrode into the work and coating the weld with a vitreous flux. It is claimed that this flux prevents oxidization. It flakes off when the metal cools. This system is interesting. The author understands that it is used with success in the welding of rails and their repair by building up worn places, but he has no experience in it beyond experimental demonstration carried out to see whether it would supersede efficiently and economically other systems in use.



FIGS. 8 AND 9. ACETYLENE-WELDED EXPANSION PIPES SEE SECTIONS FIGS. 10 AND 11.

III.—Electric Contact Welding.

Electric contact welding is performed by machinery. The Thomson-Houston process was introduced into England about twenty years ago. With it, the pieces to be welded are fixed in a machine, one immovable and the other in a slide-rest. The piece in the movable slide is pressed by means of the screw against the other, and a very heavy alternating current, the amount depending on the area of the weld, is passed through. The electrical resistance of the joint causes a rise of temperature to welding heat, and the movable piece is pressed forward until a complete union is made. A little hammering is sometimes applied to finish the joint. This system is applied to the welding of hoops for the tyres of carts, etc., wheels, angle irons and other comparatively heavy sections, and also to wire down to small dimensions. The voltage is very low, only about 2 to 4 volts. The current per square inch is about 16,000 to 20,000 amperes.

Recent Method of Contact Welding.

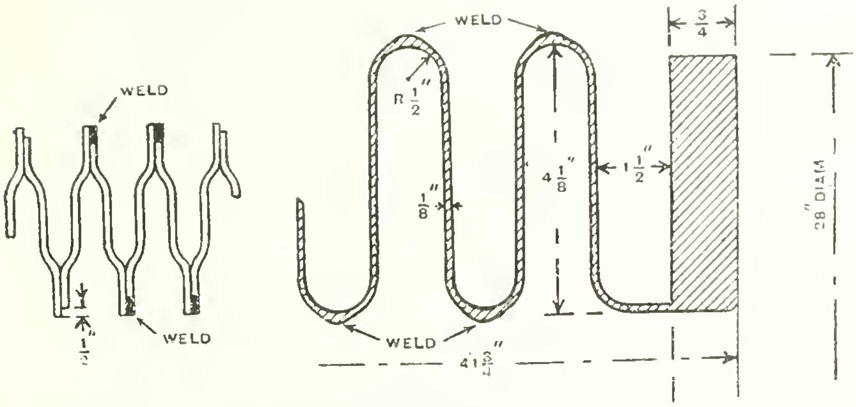
A more recent method of contact welding is also performed by machinery, but in a different manner, and it is rather delicate in its adjustment as to time and current in relation one to the other. The voltage at the welding point is low, in thin work being about 6 volts, and the current, which is alternating, is also low, but the amount depends on the thickness of the pieces to be welded. In this system there are spot welding and roller welding.

In spot welding the work is laid upon a fixed copper contact-piece or electrode. When placed in position a second, movable, electrode is pressed upon it immediately above the fixed electrode. Current is then switched on, and in passing from one electrode to the other, etc., heats and welds the work. The current is sometimes cut off automatically and sometimes by hand.

In roller welding, the system is similar, except that the electrodes are rollers which grip the work overlapped between them, heating and welding it as it travels. This system requires good quality metal; it should be homogeneous, and free from scale or dirt. The adjustment of the time the metal is between the electrodes, and the amount of current required to produce the necessary welding heat and no more within that time, are somewhat difficult to estimate. It is quite a practical system, and can produce most remarkable results in good welding. The greatest care must be exercised, however, to get these results with regularity.

The spot welds are not continuous and are like a series of rivets without rivet-holes or heads. They can be made

continuous by a series of spots overlapping one another. The roller welds are continuous. The Pontelec system is spot welding and is similar to the above, but in this system a small disk is placed between the pieces to be welded immediately between the electrodes, and the disk is crushed down into the weld. It is claimed that this disk tends to concentrate the welding heat at the weld more thoroughly than with the spot welding described in previous paragraphs. This contact welding is very economical in labor for small thin work. It requires skilful attention to keep everything properly adjusted.



FIGS. 10 AND 11. SECTIONS OF EXPANSION PIPES SHOWN IN FIGS. 8 AND 9

Gas Welding.

The heat is produced by a mixture of gas, of more or less good calorific value, with oxygen. The gas is led from its source of supply through a flexible pipe into a burner, held in the hand of the operator, and oxygen is also led into the same burner in a similar manner. The pressure of the gas and of the oxygen is regulated with suitable apparatus. The proportion of gas and oxygen is adjusted by opening or closing their respective inlet-valves on the burner, and means are provided in the burner to prevent back-firing. The gas and oxygen issue from the burner through a small orifice at the mouthpiece, and are ignited with a match, the proportions of the two being adjusted until a clear flame shows itself in a fine point. The work is heated by this flame at the welding point, and soft iron (or other metal according to the kind of metal being welded) is melted into the joint to increase its thickness and therefore its strength.

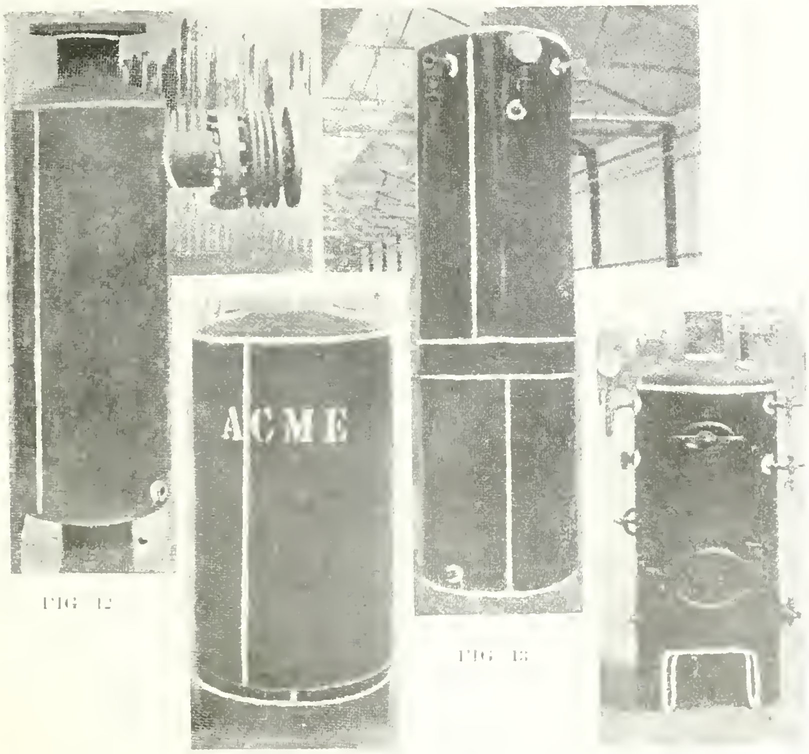


FIG. 12. FIG. 13. FIG. 14. FIG. 15.

FIG. 12. ELECTRICALLY-WELDED STEAM SEPARATOR. FIGS. 13 AND 15. RECEIVER FOR COMPRESSED AIR AND VERTICAL BOILER, WELDED PARTLY BY ELECTRIC ARC AND PARTLY BY ACETYLENE. FIG. 14. RECEIVER BODY

With regard to the gas used for this class of welding, the author thinks the best is acetylene, but other gases are used in conjunction with oxygen, namely, benzol vapour, coal gas and hydrogen, the last being used more especially on the Continent of Europe. Acetylene, oxygen and coal gas can be used together. Acetylene and oxygen form as good and effective a mixture as can be desired.

Electric Arc and Oxy-Acetylene Systems.

Of the various systems referred to herein, the author regards electric arc-welding and oxy-acetylene welding as the two systems most suitable for general application, and the rest for special work. In some classes of work, the electric arc is the more suitable, and in others the oxy-acetylene system, while in some cases both systems are equally applicable. Each is more economical in its own sphere. Owing to the lower temperature, the oxy-acetylene flame is better for thin work than the electric arc, because the risk of burning the metal is not so great. The temperature of the electric arc has been calculated as about 7,500 degs. F., but will vary with amount of current. That of the oxy-acetylene flame about 6,000 degs. F. (Murray B.O. Co.).

In the author's opinion, the electric heat must be far more effective, however, because it is produced within the work itself, whereas the heat of the gas flame is applied entirely from outside. Where the work is suitable for the electric arc, welds can be made far more quickly than by the oxy-acetylene flame. The proportions of the two gases in welding vary somewhat, but should be in the neighborhood of 1.5 volumes of oxygen to 1 volume of acetylene. This proportion is given by Mr. Murray, and agrees approximately with the author's own experience in practice. The character of work done varies very largely. The electric arc is used successfully in the repair of steel castings in which, for instance, blow holes may be effectively filled up.

Both systems are used in the welding of mild-steel plates, steel barrels and drums, steel tanks of all shapes and sizes, compressed-air receivers, steam-boilers in their manufacture and in their repair, steam-piping and fittings of all sizes, angle and tee irons and other sections; the welding of bosses or flanges into vessels. Receptacles for highly inflammable and searching liquids are made in many thousands every year for petrol, bisulphide of carbon, acetone, etc., and are quite free from leakage or evaporation. The welds are capable of withstanding high pressures, indeed the author's firm have made welds in gas cylinders which have successfully withstood a pressure of 4,000 lbs. per square inch, and welds in mild-steel tube 3-16

thick by $1\frac{1}{4}$ inches diameter inside, which have withstood an hydraulic pressure of six tons on the square inch = 20 tons on the metal. They are entirely unsupported as against the pressure. It is clear that these welds must be sound and homogenous. It is necessary to point out that this is not amateur work. To weld properly and to make the joint sound throughout, skill and training are required, together with knowledge how to apply the system as well as how to design and prepare the work for being welded.

Designing Work for Welding.

In regard to designing the work for welding, there is a wide field, and one serious consideration is the avoidance of internal stresses caused by contraction. These stresses are unavoidable, but their effect may be minimized or nullified by properly designing the shape of the article to be welded. For example, a steel boss has been welded into the centre of a flat circular mild-steel plate $\frac{1}{2}$ inch thick, with the result, that in cooling radial cracks appeared. It is probable that the material was not the most suitable quality, but the stresses were indicated. If the same plate had been dished or curved, and of good soft quality, it would have yielded to the stresses, and would have been free from fracture or risk of it. If two plates are butted together, and a third be welded upon them, here is a stress in cooling due to the contraction forcing the butted plates together in conflict with the welds. If instead of allowing the two plates abutting to touch, a space be left between, all stress is avoided. These are examples of design which may be multiplied, and will perhaps serve to illustrate the author's meaning, as they are typical cases.

The Material Feature.

Much depends on the kind or the quality of the material, which is generally steel or iron. For the generality of this work, mild steel made by the Siemens-Martin process or wrought iron cannot be excelled, and the steel should be very soft and low in carbon to get the best results. Bessemer material is not so good, as it varies greatly in the same piece, and therefore often much internal stress exists in it to begin with.

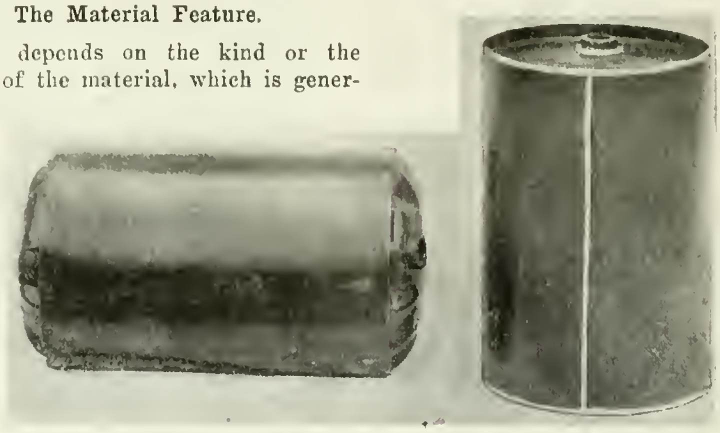


FIG. 17. TWO 5-GALLON DRUMS ELECTRICALLY WELDED.

The advantage of the kind of welding referred to herein is that, unlike the ordinary blacksmith's work, it is possible to be sure of a sound homogenous weld. The weld is built up from its foundation, and in most cases can be seen and its soundness and strength ensured, always provided it is properly and intelligently done.

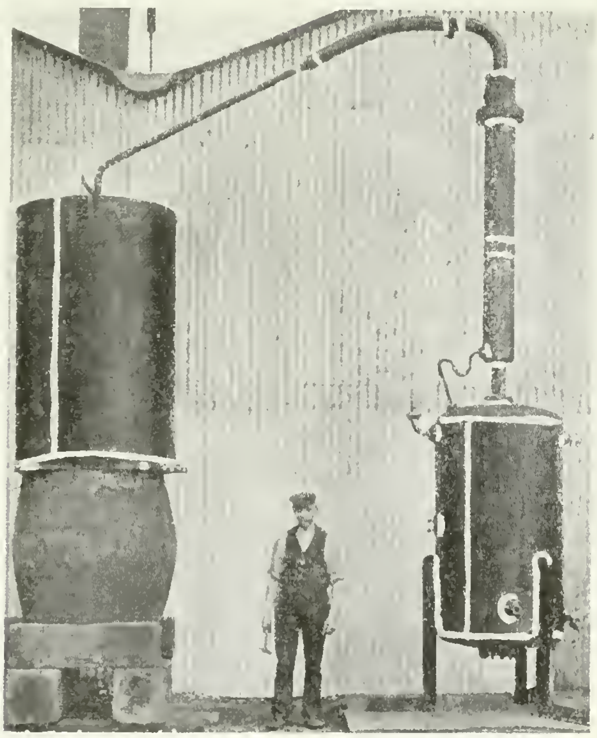


FIG. 16. STILL WITH STILL HEAD AND CONDENSER WELDED THROUGHOUT PARTLY BY ELECTRIC ARC AND PARTLY BY ACETYLENE.

Confidence in the Weld.

The author has heard the argument advanced that in electric or gas welding the result depends on the individuality of the workman. To a certain extent this is true, as it is true of most mechanical operations. In a weld, however, there is this difference from some other kinds of work, that a defect is not always apparent. With proper training and adequate supervision, however, and a suitable test there is no reason at all why full confidence should not be felt to a much greater extent in electric or gas welding than in blacksmith's welding. To give examples:—

Test Data.

A cylinder of Siemen-Martin mild steel, 20 inches internal diameter by $\frac{1}{4}$ inch thick, designed as an air-receiver for a working pressure of 100-lb. per square inch, and test pressure of 200-lb. per square inch, was submitted to a destructive test some time ago at the works of the author's firm before an engineer from the British Admiralty. The cylinder was 6 feet 9 inches long, made in two sections of length and united by a welded joint with a butt-strap welded round the cylinder. The two abutting ends of the cylinders joined were kept slightly apart to avoid internal stresses as before described. The ends were both domed outward to a radius of about 24 inches, rather too flat, but as specified, and they were $\frac{3}{8}$-inch thick. Near one end, a handhole of oval shape without any stiffening ring was cut out of the body, and a $\frac{1}{4}$-inch cover plate put inside with central bolt and bridge piece.

At 825 lbs. pressure per square inch, this cover plate pushed through the cylinder sufficiently to split the body in the solid plate, Fig. 1. The part thus split was then cut off and the end re-welded in, somewhat shortening the cylinder, and pressure again applied,

until at 975 lbs. per square inch, one end was pushed out. This cylinder had a longitudinal weld made by the electric arc system for its full length. The two ends were flanged, inserted into the ends of the body, and welded in by the oxy-acetylene process. The method of inserting the ends is indicated by Fig. 2.

In the course of the test, the circumference of the body permanently increased 2 inches, or 5/8 inch in diameter. The electric longitudinal weld showed no sign of weakness, but became extended transversely in the circumferential direction. The buttstrap prevented the cylinder becoming stretched in its immediate neighborhood, so that the cylinder after the test appeared as if it possessed a waist. The effect of the increase in diameter was to tear the body from the ends. The stress on the metal itself just before the end came out was about 17½ tons per square inch. Another cylinder, 6½ inches diameter inside by 3-16 inch thick, made of a lap-welded boiler tube, welded by producer-gas, in the usual way of such tubes, and with ends welded in by oxy-acetylene flame, burst at 1,850 lb. per square inch at the producer-gas weld, all else remaining intact.

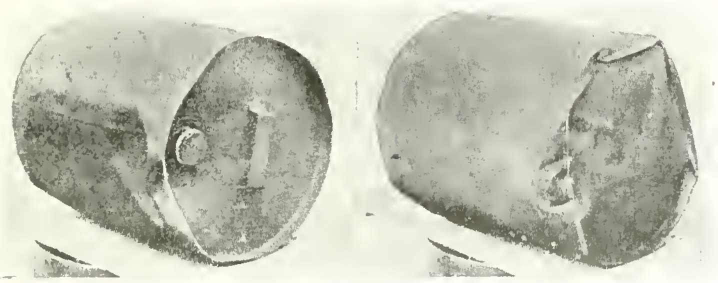


FIG. 18. TESTS OF 5-GALLON PETROL DRUMS. WEIGHT, 49 LBS. FULL. THICKNESS 19 S.W.G.

The author has tested steel-barrels by hydraulic pressure with ends quite flat and only 2 mm. thick by 21½ inches diameter, and they began to leak at a pressure of about 65 to 70-lb. per square inch. The flat ends pushed outward so as to tear the weld in this case, which was simply a fused weld made by the electric arc. The ends being flanged, fitted into the body, and were hooped inside and outside with light steel hoops, and the weld made by fusing the four thicknesses, body, flange of end, and two hoops together, to a depth of about 3-16 to 1/8 inch. The thickness of body was 1/8 inch, inner hoop 1/8 inch, flange of end 2 mm., and outer hoop 1-16 inch. At the author's works, there is a vertical steam-boiler working at 80-lb. per sq. inch, and all welded by the electric arc or by gas. Hundreds of boilers have been repaired by both processes, and their lives prolonged for years in consequence. All the foregoing examples go to show that these systems of welding are practical, reliable, and worthy of confidence in every respect.

Naturally, the character of the metal at the weld is changed to some extent. It loses some of its ductility, and some of its strength, but loses far less than does a blacksmith's weld. Many tests have shown that 89 to 96 per cent. of the original strength of metal can be relied on in the electric weld. It has been said, but quite wrongly, that the electric welding hardens the metal by filling it with carbon from the electrode. This is not the case. For example, in welding mild-steel the fierce heat of the electric arc burns out all the impurities, more or less, including carbon, and leaves the metal at the weld purer iron. If any hardening effect has ever been found, it has been due to bad manipulation or to the fact that the metal was never of a properly weldable quality, or the polarity was wrong.

The following tables are valuable in that they go to show the effects of the welding upon the metal:

Table I.—Chemical Analyses.

—	Electrically welded		Acetylene welded	
	Unwelded metal	Welded joint	Unwelded metal	Welded joint
	Per cent	Per cent	Per cent	Per cent
Silicon	[illegible]	[illegible]	0.004	0.002
Carbon	[illegible]	Trace	[illegible]	Trace
Sulphur	0.025	0.020	0.085	[illegible]
Phosphorus	0.068	[illegible]	[illegible]	[illegible]
Manganese	0.64	0.25	0.49	[illegible]
Iron (by difference)	99.108	99.664	99.198	[illegible]
—	100.000	100.000	100.000	100.000

For these analyses, drillings were obtained from the plates themselves and also drillings from the welded joints. The plates were tested mechanically, both longitudinally and transversely along the welded joints, and, for comparison also the unwelded metal. The results of the mechanical tests of the unwelded metal are the mean of three lots.

These chemical analyses and also the mechanical tests were specially made for the author in August 1913, by Mr. F. C. Tipler, chief chemist, Locomotive Department, London and North-Western Railway, Crewe. The pieces of material were prepared at the works of the Steel Barrel Co., at Uxbridge, and were of Siemens-Martin open hearth steel, 1/8-inch thick.

Chemical and mechanical tests of acetylene and electrically-welded plates,

Table II.—Mechanical Tests on Mild Steel 1/8 in. Thick.

—	Electrically Welded			Acetylene Welded		
	Unwelded	Welded joint		Unwelded	Welded joint	
		Transverse	Longitudinal		Transverse	Longitudinal
Elastic Limit Tons per sq. in.	15.20	17.60	Nil	13.76	11.60	Nil
Breaking Weight Tons per sq. in.	26.66	24.00 = 90%	25.60 = 96%	23.14	18.24 = 78.8%	23.20 = 100.2%
Contraction of area Per cent	47.25	Nil	Nil	46.66	49.60	Nil
Extension on 4 inches Per cent	23.16	5.00	0.50	26.33	13.50	4.25
Extension on 2 inches Per cent	30.33	7.00*	1.00†	33.66	22.00‡	8.00

* Broke in weld † Broke outside gauge length. ‡ Broke clear of weld.

received from Mr. Heaton, of the Steel Barrel Co., Ltd., Uxbridge, August 27, 1913:

One of the strips tested (Table 3) consisted of the original material, and the second one was a piece cut from the same sheet, cut into two and electrically-welded at the joint. This material was of a somewhat softer nature than that referred to in Table 2.

Examples of Electric and Acetylene Welding.

In order to show some of the applications of electric welding and of acetylene welding, some illustrations are appended. White lines on the examples indicate the welds.

Fig. 1 is a drawing of an outside buttstrap joint of the kind referred to in the descriptive notes relating to Fig. 13.

Fig. 2 represents the method the author considers best for welding an end into a vessel to resist internal pressure. The form of the end is best suited for the stresses due to the pressure, and by the system adopted, any required thickness of weld, or rather length of weld, can be made. This drawing also shows an inside butt-strap joint.

Fig. 3 is the photograph of the welded-cylinder tested to destruction, and previously described.

Fig. 4 shows a piece of work fixed on an anvil and in process of being welded by the electric arc. The resistance coils for adjusting the current are

Table III.—Mechanical Tests on Two Strips of Siemens-Martin Mild Steel Sheet 1/8 in. Thick.

—	Breadth of Testpiece	Thickness	Area	Maximum Load		Extension on 4 in. Length	Reduction of Area	Remarks
				On Piece	Per Square Inch			
	Inch	Inch	Square inch	Tons	Tons	Per cent	Per cent	
1	1.460	1/8	0.185	4.06	21.95	32.03	29.63	Original
2	1.478	1/8	0.185	4.59	19.41 = 88.42%	10.[illegible]	[illegible]	Electrically welded

clearly shown, also the carbon holder and the hand screen used by the welder. This kind of joint is made by abutting the two parts, and is thickened by adding pieces of scrap of the same material. The electric arc heats the metal, and as soon as the proper degree of heat is attained, the welder puts down his carbon, uses the swage shown in the illustration, and the striker hammers it, and so toughens the weld.

Fig. 5 shows a mild-steel water-jacketed exhaust pipe being welded by acetylene and oxygen. This is a flash-light photograph, and the welding flame is clearly shown. Three types of burner are shown in this illustration. That nearest the welder is a Fouché burner, while the middle one is the type of burner recommended by the British Oxygen Co. For different thicknesses of work it is necessary with both these types to have different sizes of burners. The third burner shown is made by a firm in Brussels. It is of copper tube and is flexible. This burner is supplied with various sizes of nozzles, and of adjusting pieces, so that the same burner can be adjusted to suit a large range of thickness.

Fig. 6 shows a water-jacketed exhaust pipe made of steel sheet 1-16-inch thick, with six exhaust branches, and with an inlet and outlet for water circulation. The length is 4 feet, and the weight 28 lbs. It was for a racing boat, and was acetylene welded.

Fig. 7 shows another exhaust pipe not jacketed, for a motor-car, also acetylene welded. This is very light compared with the ordinary cast-iron pipe in the place of which it was required.

Fig. 8 represents an expansion pipe in mild-steel welded by acetylene. It was designed to go between a steam-turbine and its condenser, and had an internal diameter of 4 feet 6 inches. The form is similar to that of a concertina, being made in circular sections, 1/8 inch thick, welded together along their inner and outer peripheries. The flanges were also welded on, these being 1/2 inch thick.

Fig. 9 is an expansion pipe of somewhat different form, 18 inches diameter.

Fig. 12 shows a steam separator, having the longitudinal joint of the body electrically welded. The rest of the welds were made by acetylene. The diameter of separator was 18 inches; length of body 4 feet; thickness 1/4 inch; inlet pipe 7 inches, with flange 14 inches diameter by 1 1/8 inches thick; and outlet pipe 6 inches diameter. The boss for drain-pipe connection at bottom of the body was welded in electrically.

Fig. 13 shows a receiver for compressed air, 10 feet high by 3 feet diameter. This was welded partly by the electric arc and partly by acetylene. The butt-strap welded round the body may be noted. It is to connect the two sections together. The working pressure of the receiver is 100 lbs. per square inch.

Fig. 14 is a smaller receiver body, 1/8-inch thick, with ends 3-16-inch; test pressure, 300 lbs.; diameter, 16 5/8 inches, and length, 2 feet 6 inches.

Fig. 15 represents a vertical steam-boiler, welded partly by the electric arc and partly by acetylene, for a working pressure 80 lbs. per square inch.

Fig. 16 shows a still for distilling benzine, with still-head and condenser welded throughout partly by the electric arc and partly by acetylene. The feet are of T section welded on the still.

Fig. 17 represents two 5-gallon electrically-welded drums made by contact welding. One was tested by hydraulic pressure to 90 lbs. per square inch before any leak showed itself. The diameter is 12 inches inside, and the thickness of steel sheet 20 B.G = 0.996 mm. Under pressure the permanent set of the ends is clearly shown.

Fig. 18 is an exactly similar drum to Fig. 17. The photograph shows two views. This drum having in it 5 gallons of petrol was dropped seven times, starting from 3 feet and including two falls on solid iron, one 8 feet 6 inches and one 15 feet, and a final fall of 19 feet on to a macadam road. There was neither fracture nor leakage.

G.T.R. "SAFETY FIRST" MOVEMENT.

THE SECOND monthly meeting of the General Safety Committee of the Grand Trunk Railway System was held on Monday, February 23, in the room of the Board of Directors at the General Office Building in Montreal. Howard C. Kelley, vice-president, presided, and there also attended, U. E. Gillen, general superintendent, Chicago, Ill.; H. E. Whittenberger, general superintendent, Toronto; H. R. Safford, chief engineer, Montreal; T. W. R. McRae, chief claims agent, Montreal, and George Bradshaw, safety engineer, Montreal.

Reports received from twenty-three Safety Committees, located at various points on the system showed that during January last, members of the Safety Committees corrected 445 unsafe physical conditions and cautioned employees against unsafe practices in 433 cases. The report of the secretary showed that the influence of the safety movement is being felt in a constant reduction of injuries to employees and patrons, the results for January being more favorable than for any previous month, notwithstanding the severe weather, which often is an indirect cause of casualties.

SMOKEBOX CINDERS AS FUEL.

IN THE ZEITSCHR. des Ver. Deutsch. Ingen., recently, Mr. O. Nerger emphasizes the importance of utilizing locomotive cinders for heating purposes, and describes the various plans put forward up to the present to do so. Experiments with chain grates and other mechanical methods of stoking have not been entirely successful. The management of the Royal Breslau Railway Co., which is building a new head workshop at Oels, has recently engaged in exhaustive researches on this subject. At the suggestion of Mr. Cohn, the Government engineer, these researches were extended to the forced draught traveling grate Pluto stoker, because it had already been found possible with this device to burn up profitably coke cinders, anthracite dust, and other non-gasing fuels of that nature.

Its chief element consists of a hollow grate piece which is movable to and fro, and is provided with slots on its inner or heated surface. Compressed air enters the furnace through these slots, pre-heating the air, and preventing any lowering of the general temperature of the furnace. In earlier trials, the cinders showed a tendency to cake together in spite of the motion of the hollow grate, and so their passage over the slots was impeded. The caking of the cinders also stopped up the slots and hindered the entrance of air. Thus the cinders were not completely consumed and a considerable proportion of unburned materials was found in the residues.

A number of slight modifications, such as regulating the speed and throw of the grates and the pressure of the air, remedied these defects, but the chief improvement consisted in introducing steam into the hollow grate bars as it loosened the clinkers and allowed the air to have free access to the furnace. The success of the arrangement is due to the continual loosening of the fuel by the to-and-fro motion of the bars, thus giving the air of combustion access to all parts of the fuel.

Flywheel Query.—H. Westwood, Stratford, Ont., has sent in the following problem for solution by readers:—A flywheel 12 ft. in diameter, and weighing 10 tons, revolves at a speed of 150 r.p.m. It is built in halves, these being secured by four 2 1/2 in. bolts at the hub, and by four 2-in. bolts at the rim. If there is a tensile strain of 1,000 pounds on each of the hub bolts and 700 pounds on each of the rim bolts when the engine is standing, how much strain is there on the respective bolts when the engine is running at normal speed?

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

TENSION ON CYLINDER COVER STUDS.

By A. E. W.

SINCE sending in my first contribution on this interesting subject for the Feb. 19 issue, I have come across a solution by a well-known expert, whose conclusions will doubtless be of interest to my fellow-readers. The authority referred to is Professor Unwin, whose "Elements of Machine Design," is a widely used text-book on the subject. Doubtless many readers are familiar with the book; and if they will turn to page 182 of Volume I., they will find the matter gone into very fully. For the benefit of those who do not know the book, I have here extracted part of the chapter dealing with bolts and nuts, and have made a copy of the sketches accompanying the section.

Straining Action on Bolts.

Professor Unwin says:—"Suppose a plate be suspended by two bolts, and a load (2W) hung midway from it (Fig. 1). The tension on each bolt will be T =W, and the case presents no ambiguity. Commonly, however, the plates which are themselves to some extent elastic, are screwed tightly together, with a more or less compressible packing between them, and there is an initial tension in each bolt before the load is applied. This tension is balanced by the elastic reaction of the pieces fastened together. The case may be diagrammatically represented by imagining the plates rigid and elastic springs interposed, Fig. 2. Then the arrangement being symmetrical, each bolt has initially a tension, ($T=C_1$), due to the compression of the springs by screwing up. Let a load (2W) be now applied, Fig. 3. The tension in the bolts will increase, they will stretch and so diminish the compression of the springs, and the tension in the bolts will have same value between (W) and ($W+C_1$), depending on the relative elasticity of the bolts and springs.

"If (W) be increased till the stretch of the bolts is equal to the initial compression of the springs, (C) vanishes, and, for this or any greater load, the tension in each bolt will be ($T=W$), as in Fig. 1. In most practical cases, however, the initial tension due to screwing up must be sufficient to prevent this, or there would be a sensible separation of the connected pieces.

"Let the extension of the bolts be (A) and the compression of the springs (B) per unit of load, then initially the compression of the springs is (BC_1). When the load is applied, the bolts stretch an amount A ($T-C_1$), and the compression of the springs is equally diminished. Then,

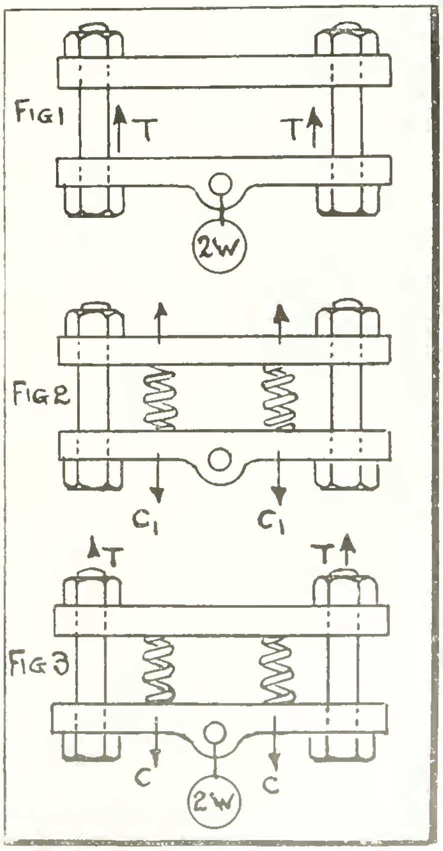
$$BC = BC_1 - A\,(T - C_1)$$

$$C = C_1 - \frac{A}{B}\,(T - C_1)$$

$$T = W + C = W + C_1 - \frac{A}{B}\,(T - C_1)$$

$$= \frac{B}{B+A}\,W + C_1$$

"If the springs are very rigid compared with the bolts, as when the bolts connect two strong flanges, (B) is small



TENSION ON CYLINDER COVER STUDS.

compared with (A), and then ($T=C_1$), or the initial stress due to screwing up is not increased by adding the load.

"If the extension of the bolts be equal to the compression of the springs per unit load, (B=A), and then ($T=\frac{1}{2}W + C_1$), and this case might occur when there is elastic packing to make a tight joint between strong flanges.

"Lastly, if the extension of the bolts be small compared with the compression of the springs ($T = W + C_1$)

"In the more ordinary cases, therefore, the load on the bolt depends chiefly on the strain put on initially in screwing up. Since workmen may exert considerable force in screwing up bolts, the strength of the latter must often be much more than would be necessary if the load only were considered."

From the above it will be noted that Professor Unwin states that the load does not increase the initial tension in the bolts when the heavy flanges are bolted together, as in the case of a cylinder cover metal-to-metal joint. Of course the stress in the bolts would be increased if the load exceeded the initial tension, but in such a case the joint would not remain tight.

Where an elastic packing is inserted in the joint, the load does increase the initial tension in the bolts, so that the two rules quoted in my first contribution would seem to hold good.

Discussions on subjects of this nature are certainly very interesting, as is clearly evidenced by the number of readers who are taking part in this one. I hope we shall have more of them.

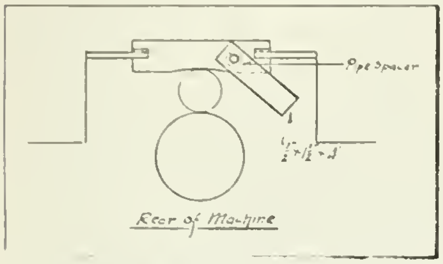
MILLING MACHINE KINK.

By D. A. Hampson.

WE had about twenty-five milling machines going all the time at capacity; about half of them were Lincoln type, and, like so many Lincolns the table feed was short, so short for the work that an inch or two was all the travel we could allow for loading, beyond the actual cut. Quite naturally the boys would give themselves a little more room away from the cutter and as a consequence somebody ran the nut off the screw every hour of the day, when the table was shoved on the nut got a bang which didn't help the last thread any. Moving the table with the nut only half engaged as it was with the short clearance at the end, was bad enough. These two causes and the forcing of cuts through steel wore the nuts out rapidly. Now, babbitting one of these nuts and getting it a good fit and getting it perfectly aligned is no cinch. Everyone who has tried knows that

We decided that prevention was better than cure For that end machine was supplied with a positive stop to prevent the nut from being run out; the stop be-

ing applied at the rear where it was least apt to be meddled with, and set, not adjustable, so that at the limit the screw engaged the full nut length. The stops consisted simply of a ½ in. or 1½ in. stop secured to the rear end of the



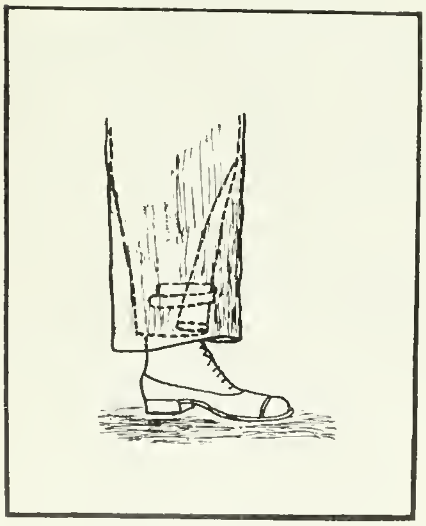
PREVENTING MILLER TABLES BEING RUN OUT.

table by a heavy bolt. A pipe spacer, faced to the right length for each particular machine, offset the stop when the table had to be moved beyond the rear of the saddle. In loading position, the work was then nearer the cutters, and cutter guards were supplied so that the operators could work expeditiously and in safety.

KINK FOR PUTTING ON OVERALLS

By James E. Cooley.

EVERY workman knows that each time when putting on a pair of overalls the legs of the trousers become drawn up and have to be pulled down and smoothed out, as they feel uncomfortable when humped-up. A useful kink to prevent this, and shown in the



KINK FOR PUTTING ON OVERALLS.

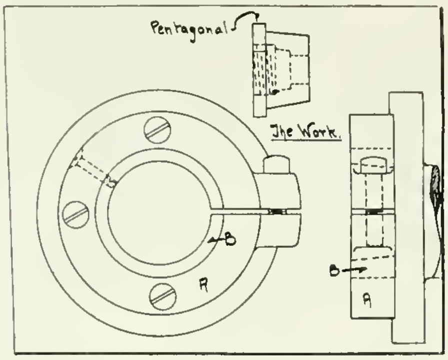
illustration, is to fold the trouser-leg about the ankle and fasten with a bicycle-clip. The overalls will then slip on easy. The clip should be left on, as it prevents dust and dirt from getting up inside the trouser-leg

FIXTURE FOR TAPERED WORK.

By D. A. Hampson.

ONE of the jobs that reappeared from time to time was the boring and threading of cast iron pieces such as shown in the drawing. They came to us turned on the outside and with the small hole drilled Our work was to drill or bore out the larger hole (tapered) or to cut the internal thread. The reason for this division of labor between two shops was not apparent and we did not question it; every month from one to four dozen would come in to be threaded and bored. The tapered end made the pieces hard to hold securely and true. Special sizes were in use and it was decided to make a simple fixture that would accommodate itself to all sizes and to the taper.

A casting (A) was made up, faced and bored, with a central hole larger than any of the work pieces. This casting was bored out after screwing to a face plate which was prepared for same by



FIXTURE FOR TAPERED WORK.

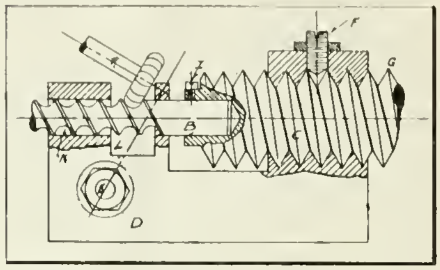
turning out 1-16 inch deep as shown. A saw cut and a binding bolt completed piece (A). To adapt the casting to the work pieces, cast iron sleeves, straight on the outside and of the proper taper on the inside were made for each of the various sizes. These sleeves were split and are shown at (B).

In operation, the parts were assembled on the lathe. The work was put in the proper sleeve and the screw tightened. By this method, the pieces were "chucked" quickly and firmly. The fixture was cheap and easily adapted to the different sizes; it held without slippage on the tapered (3½ deg.) surface.

SPIRAL MILLING ON THE LATHE.

By H. Womersley.

THE great range of work that can be done on the engine lathe is not fully appreciated. The accompanying sketch shows a very useful arrangement for spiral turning. The cutter (A) is held on the lathe spindle, and (B) is the work-piece, which in this case is a rod in which a long spiral groove has to be milled. The holder or chuck (C) of the work-piece (B) is such as to enable a great number of pieces to be made at low cost. The permanent attachment (C) has a thread (G) which serves as a guide, and has the same pitch as the required grooves on (B). The casting



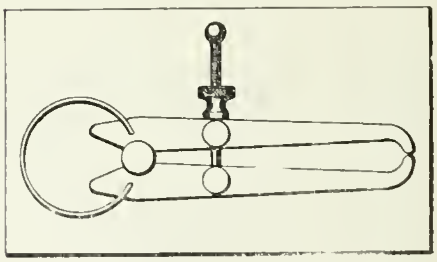
SPIRAL MILLING ON THE LATHE.

(D) is fastened on the lathe by the bolt (E), which holds it fast on the tool-post plate. After the attachment is brought to the proper angle to give the tool (A) the right pitch, the entire apparatus can be given a to-and-fro movement by means of the cross feed. The opening (K) in the casting (D) is exactly the same diameter as the rod to be milled, and as a consequence supports the latter. The opening (L) permits entrance of the cutter. By turning (C) with the hand the work-piece is fed forward.

SPECIAL OUTSIDE CALIPERS.

By D. A. Hampson.

A HANDY caliper—one that every machinist should have—is that here illustrated. It is an "outside" spring caliper with straight legs and short points The writer has made a number of them from inside spring calipers by disassembling, filing notches on the opposite sides of the legs for the spring and the centre stud, and reassembling in reverse of their original position. A four-inch caliper is large enough for most of the work required of such a tool, and such a one converted would represent an outlay of about seventy-five cents and perhaps a half-hour's



SPECIAL OUTSIDE CALIPERS.

work. Many a time such a tool is worth twice that to a man who finds he has no tool in his kit that can be used for some certain job.

The uses of this caliper are many. For inspection purposes, it is particu-

larly adapted. Assume that a small hole is to be drilled centrally in some rectangular blocks. How can its true location be determined? The anvil of a micrometer will not enter the hole. Outside calipers cannot be used—the big-bowed legs not permitting, while rivet joint inside calipers are too slow and too uncertain. The calipers shown are ideal for the task—sensitive, quickly changed and small enough ends to enter the hole so that any mechanic worthy of the name can detect a difference of .0015 in. between two measurements with them. On the planer and shaper they are very handy to measure the thickness of work being planed which is held in a vise or on parallels, but in such confined space (vertically) that bow calipers are out of the question.

CANADIAN SHIPBUILDING WANTS GOVERNMENT AID.

A DEPUTATION representing the shipbuilding industry waited upon Premier Borden and members of the Cabinet on March 4 and urged Government co-operation in the development of shipbuilding in Canada. The following were included in the deputation:—Thomas Long, Toronto; Capt. McDonald and R. B. Wallace, of Port Arthur; J. Sword, of Kingston; P. L. Miller, of the Canadian Vickers, Montreal; J. B. Miller, of Toronto; Thomas Hall, of Montreal, and George Davie, of Quebec.

It was urged by the members of the deputation that as the plant of the companies represented a heavy investment, every effort should be made by the Government to throw business their way. In recent years, it was pointed out, the Government had placed orders for dredges, etc., outside of Canada. It was urged that in the future the Government place all such orders with Canadian firms.

Some objection was also taken to the fact that the Government, though professing to encourage Canadian shipbuilding on the part of others, had gone into the business itself, and in many cases had vessels built at the Sorel shipyards. Some of the members believed that the Government should not be in the business now that the industry had become pretty firmly established.

Northern Electric Co., Ltd.—The recently incorporated Northern Electric Co., Ltd., has taken over the Northern Electric & Mfg. Co. and Imperial Wire & Cable Co. The business previously carried on by the two latter concerns will be conducted by the newly-organized company without change in management.

QUEBEC MINERAL PRODUCTION.

A STATEMENT of the mineral production of the province of Quebec for the year endng December 31st, 1913, as prepared by Mr. Thee C. Denis, superintendent of mines, shows that the value of the products of the mineral industry of the province of Quebec in 1913 totalled $12,918,109. The mineral production for 1913 is the highest yet recorded. For the last ten years there has been an unbroken series of increases of each year over the preceding one, the value of the output having been quadrupled in the decade.

The table of production in the province of Quebec for the year ending Dec. 31st, 1913, is as follows:—

Substance.	Value.
Asbestos	$3,825,959
Asbestic	20,245
Copper and sulphur ore	866,774
Feldspar	1,554
Gold	14,794
Graphite	9,620
Iron ore bog	.....
Iron ore titaniferous	9,824
Kaolin china clay	4,354
Mica	117,038
Mineral water	31,728
Ochre	40,868
Phosphate	3,506
Quartz and phonolith	2,363
Silver	21,791
Zinc and lead ores	7,379
Structural Materals—	
Brick (M)	1,272,092
Cement	3,361,292
Flagstone	....
Granite	482,338
Marble	120,541
Lime	452,330
Limestone	1,570,455
Sand	343,750
Sandstone	5,072
Slate	6,286
Tile, dray and sewer pipe pottery, etc.	326,165
Total	$12,918,109

Asbestos Market.

There has been a marked improvement in the asbestos market, although the conditions are not yet ideal. The working margin of profits in the asbestos industry is narrow.

Except for the very appreciable increase in the shipments of copper and sulphur ore, there are no new developments in the industry. The value of the copper and sulphur contents of these ores amounted to $866,774 in 1913. This is an increase of $234,811 as compared with 1912.

The iron ore and iron smelting industry has been dormant in the province for over two years. There has been no production recorded since 1911, and the prospect for a resumption of activity is not of the brightest.

The titaniferous iron ore recorded comes from Sturbain and from Ivry. It is used as an ore of titanium, of which element it contains from 18 to 30 per cent.

The figures of gold and silver represent the contents of these metals in the copper and sulphur ores of the Eastern townships. The Beauce placers were not operated during 1913.

The results in the graphite industry have been very disappointing. The mills of the Dominion Graphite Co., the largest producers in 1912, did not reopen. Most of the other graphite plants report greatly reduced operations, with the exception of the Quebec Graphite Co., at Buckingham, which worked actively throughout the year, but mostly on experimental work.

Although the production of china clay is yet very small, the outlook is promising. The Canadian China Clay Co., working a deposit in Amherst township, Labelle County, have put in an experimental washing plant.

The whole of the output of Kaolin is sold to paper manufacturers, who use it as a filler.

Structural Materials.

Notwithstanding the general trade depression which prevailed during the year, it is gratifying to see that the production of structural materials more than held its own as compared with 1912. The figures for cement, limestone, granite, and brick show increases. This indicates that, despite adverse conditions, the general development of the province of Quebec was not in any way retarded, for the production of structural materials is a very good criterion of such progress.

During the session of the Quebec Legislature which has just closed, an amendment to the Quebec mining law was passed, reducing the price of mining concessions, from $20 and $10 an acre (according to distance from railway), to a uniform price of $5 an acre.

In 1913, according to returns received, 8,996 men found employment in the mines, quarries, clay pits, and ore mills in the province of Quebec. The total wages paid amounted to $5,179,395. A certain proportion of these men were employed for part of the year only, but the majority worked 300 days.

During 1913 there were 15 fatal accidents. Of these, ten occurred in the asbestos mines, four in quarries, and one in a copper mine.

The Babcock & Wilcox Co., Ltd., Toronto, have received an order for four 300 h.p. boilers from the Canadian Kodak Co. for their new factory at Mount Dennis, Ont. They are also supplying a 150 h.p. boiler to the Moose Mountain Mines at Fellwood, Ont.

SUPERHEATING STEAM IN LOCOMOTIVES.*

By Henry Fowler.

THE utilization of steam superheated, or of a higher temperature than saturated, has engaged the attention of engineers since the inception of the use of the expansive power of steam, i.e., since the middle of the eighteenth century. Its application in locomotives was suggested over 85 years ago, and for half a century many attempts were made to employ it in this class of engine. Owing to trouble arising from the packing and the lubrication, these were not successful, and the prominent position it occupies at the present day is very largely due to the investigations of Dr. Wilhelm Schmidt, of Cassel, and to the practical trials of his apparatus made by Mr. R. Garbe, of tthe Prussian State Railways. Various types of superheaters were tried, but the one now in most general use is that in which the steam receives its superheat when passing through small tubes placed in large smoke tubes through which the heated gases travel on their way from the firebox to the chimney. This type is general in England, where, in addition to the Schmidt system, the Swindon and Robinson systems, which differ from the Schmidt in detail only, are also employed. The utilization of the heat in smoke-box gases has been tried repeatedly, but without much practical success.

Under ordinary conditions, when an engine is running, the steam passing through the superheating elements carries away with it sufficient heat to keep the metal of the elements comparatively cool. When, however, a locomotive is running down an incline without steam, this does not occur, and it is necessary to prevent the gases from passing through the fire-tubes, which is effected by a damper or some other type of retarded. Arrangements are generally made for working the dampers or retarders automatically. The connection between the superheater elements and the header from which steam is distributed is a matter of importance, and the methods by which this is done constitute one of the chief differences between the various fire-tube superheaters. Essentially, however, they consist of those in which a joint is made between the pipe and the collector, and those in which the former is expanded into the latter.

Provision Against Trouble.

Piston-valves are employed almost exclusively in locomotives using superheated steam. These have to be of special design, owing to the greater fluidity of superheated steam and to the difficulty of efficiently lubricating any surface to which highly superheated steam has access and which has a heavily loaded machine-part passing over it. For the same reasons special attention has to be paid to the design of the piston-head. The high temperature of the steam necessitates glands of special design wherever they are required, as well as arrangements for cooling the glands by allowing access of air where possible. The packing used requires to be of special high-melting composition, and here, as elsewhere, it is necessary to design the parts so that as little pressure as possible exists between two surfaces which are exposed to the temperature of the highly-superheated steam. The oil used for lubrication is generally a mineral oil which has a high flash-point and which is fed into the various parts by a mechanical lubricator which will ensure a definite, determined amount of the lubricant being delivered regularly at the necessary points. The provision of a pyrometer which allows the engine-driver to know at what degree of superheat he is working is advisable. Owing to the use of piston-valves which do not permit the relief of compression or suction in the cylinders when running with the regulator shut, it is necessary to provide by-pass and vacuum relief valves. Some of these valves are also suitable for dealing with any water which may be carried over into the cylinders, whilst in other cases special relief valves are fitted. The large tubes in which the superheater elements are placed give little trouble.

The greater volume of superheated steam, when compared with saturated, has in many cases led to the adoption of larger cylinders and lower boiler-pressure. This leads to economy in boiler-repairs, which should counterbalance the increase of maintenance necessary for the extra apparatus required when superheated steam is used. The degree of superheat usually employed is 230 degrees to 260 degrees F. No figures at present seem to be available for the variation in the economy with varying degrees of superheat.

Chief Advantage.

The chief advantage claimed for the use of superheated steam in locomotives is the economy in coal-consumption, and on the Midland Railway, a number of trials have been made to ascertain what this is with the various types of engines, the comparison being made on the consumption per ton-mile under circumstances as nearly comparable as possible. These trials show that a saving of 23 per cent. in the coal consumption and of 22 per cent. in the quantity of water used, was obtained in one case, whilst in another, where the difference between the locomotives was solely in the superheater, the saving of coal was as high as 30 per cent. This high figure was probably due to the engine which used superheated steam having more reserve of power than the one employing saturated steam. From diagrams of these two engines it can be shown very clearly how much more fluid superheated steam is than saturated.

Experiments have been carried out to ascertain the effect of superheating the steam supplied to the high-pressure cylinder of a three-cylinder compound locomotive, and it has been found that a saving of coal of 25.9 per cent. and of water of 22.3 per cent. has resulted when comparison is made with a similar engine using saturated steam. In tests carried out with goods-engines, the coal-saving has been from 14.3 per cent. to 18 per cent.

*From a paper read recently before the Institution of Civil Engineers.

READER, WHAT DO YOU KNOW?

Among readers of Canadian Machinery there is a clearly defined sincerity of desire to know how each overcomes the daily tasks of the machine, pattern and blacksmith shops, the foundry and boiler shops. It is believed that your methods and devices, while good, may be improved, and thereby made more valuable if you publish them, so that other brains may work on them. We will provide the setting and pay you for the material. When your fellow tradesman puts the superstructure on your foundation, we pay him and pass the "kink" on to you, free. Get into the game.

The Canadian Stewart Co., Ltd., Toronto, have ordered a derrick scow from the Polson Ironworks. The vessel will be 120 ft. long, beam 42 ft., and 9 ft. deep.

Canadian Allis-Chalmers, Ltd., Toronto, have been appointed exclusive agents for Canada and Newfoundland of the Avery Automatic Scales. The parent factory, at Birmingham, England, was established almost 200 years ago, and is, without doubt, the oldest and largest scale concern in the world, comprising factories in England employing 5,000, and another at North Milwaukee, Wis. The Avery scale in the Canadian Government elevator at Port Colborne, Ont., constitutes the largest installation and the largest automatic grain scale in the world.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Attention is drawn to the alternating course in arithmetic, a concurrent study of which is recommended with that of the Question and Answer Series.

Question.—A railway train starting from rest along a level piece of track acquires a speed of 30 miles per hour in five minutes. What has been the **mean pull between the locomotive and the train**, if the resistance to motion is 10 lbs. per ton and the train weighs 225 tons. Take a ton as meaning 2,240 lbs.

Answer.—The constant pull due to resistances $= 10 \times 225 = 2{,}250$ lbs.

$$\text{Mass of train} = m = \frac{225 \times 2240}{32} = 15{,}750.$$

$$\text{Velocity of train} = v = 30 \text{ m.p.h.} = \frac{30 \times 5280}{60 \times 60} = 44 \text{ ft. per second.}$$

Momentum of train $= m \times v = 15750 \times 44$, and time taken to produce this momentum $= 5 \times 60 = 300$ seconds, therefore the main pull producing change of motion is $\frac{15750 \times 44}{300} = 2{,}310$ lbs., and the total mean pull between the engine and train is $2250 + 2310 = 4650$ lbs.

* * *

Question.—A screw jack has a screw of ½-inch pitch. If a force of 50 lbs. be applied at the end of a 36-inch lever and the efficiency of the jack is 40 per cent., what weight can be raised by it?

Answer.—Neglecting friction, the power put into the mechanism is equal to the power given out by it. That is to say, the force applied at the end of the lever multiplied by the circumference it describes in one revolution is equal to the pitch of the screw multiplied by the weight raised. In the present case, the efficiency is only 40 per cent., the other 60 per cent. being lost in friction. The weight actually raised by the jack will, therefore, be .40 of the weight theoretically raised. Calling the latter W lbs., we have

$$W \times \tfrac{1}{2} \text{ in.} = 70 \times 2 \times 36 \times 3.1416 \times .40.$$

$$\frac{W}{2} = 633.35.$$

$$W = 1266.7 \text{ lbs.}$$

* * *

Question.—What is the distinction between **energy** and **power**?

Answer.—Energy is the capability of doing work which a body may possess by reason of its position, condition, or motion. It is of two kinds. Thus, there is **potential energy**, or that form of energy which a body possesses in virtue of its position or condition. For instance, when a pile driver drop weighing 50 lbs. has been raised 20 feet it has a potential energy of 1,000 ft. lbs.; for it takes that amount of work to lift the 20 lbs. through 20 feet; and, if then allowed to fall, the drop will naturally give out the same amount of work. An example of potential energy due to the condition of a body is found in the coil spring of a watch or clock.

The energy due to the motion of a body is called **kinetic energy**. For instance, in the first example cited above, the pile driver drop weighing 50 lbs., in falling freely through 20 feet, had stored up in it, due to its motion, an amount of work equivalent to 1,000 ft. lbs.

Power is the **rate** of doing work, or the work done in a given time. The unit of power in this country is the horsepower and is the rate of doing work, equivalent to 33,000 ft. lbs. per minute.

* * *

Question.—In a wheel and axle the radius (R) of the wheel is 20 in.; the radius (r) of the barrel is 4 in.; and the weight to be lifted is 300 lbs. Find the force (P) to be applied?

Answer.—$P = \frac{300 \times 4}{20} = 60$ lbs.

* * *

Question. — The crank or handle which turns a windlass is 14 in. long. What must be the diameter of the axle when a man exerting a force of 60 lbs. upon the handle raises a weight of 2 cwts.?

Answer.—$\frac{14 \times 2 \times 60}{112 \times 2} = 7\tfrac{1}{2}$ in.

* * *

Question. — What weight may be raised by a block and tackle with three sheaves in each block, when the force (P) applied is 30 lbs.?

Answer. — $W = 30 \times 6 = 180$ lbs.

* * *

Question.—The two blocks (A) and (B) of a block and tackle weight 25 lbs. each, and the weight (W) is 200 lbs. The whole is held in equilibrium by a certain force (P) applied at the fall of the cord. What will be the pressure on the hook which supports the blocks?

Answer. — The total load to be raised $= 200 +$ weight of bottom block $= 200 + 25 = 225$ lbs. There are six cords, therefore, $P = \frac{225}{6} = 37\tfrac{1}{2}$ lbs. The total load suspended on hook will consequently equal $200 + 25 + 25 + 37\tfrac{1}{2} = 287.5$ lbs.

* * *

Question. — The upper block of a rope and pulley lifting tackle has three pulleys, and the lower block has two pulleys. What force (P) in lbs. applied to the fall, will lift a weight of 4 cwt.?

Answer.—$P = \frac{4 \times 112}{5} = 80\ 3/5$ lbs.

* * *

Question. — In a Weston's pulley block, the effective radii of the compound pulleys (i.e., from the centre of pulley to the centre of chain which passes round it) are 4 in. and 3½ in. respectively. Find what weight (W) can be lifted by a force of 20 lbs. (neglecting friction).

Answer.—

$$W = \frac{2 \times 20 \times 4}{(4 - 3\tfrac{1}{2})} = \frac{160}{.5} = 320 \text{ lbs.}$$

* * *

Question.—The base of an inclined plane is 20 feet long, and the height 6 feet. Find the length (L) of the incline?

Answer.—$L = 202 \times 62 = 20.88$ feet.

* * *

Question.—The base of an inclined plane is 20 feet long and 6 feet high. What force (P) acting parallel to the plane will pull up a body weighing 300 lbs., when the co-efficient of friction between the body and the plane is .25?

Answer. — Work due to gravity $= 300 \times 6 = 1800$ lbs. Work due to friction $= 300 \times .25 = 1500$ ft. lbs. Total work $= 1800 + 1500 = 3300$ ft. lbs. The length of incline is 20.88 feet, as above, therefore,

$$P = \frac{3300}{20.88} = 158.04 \text{ lbs.}$$

* * *

Question.—A train of wagons weighing 80 tons is supported on an inclined plane rising one foot for every 60 feet of length, by a wire rope attached to a stationary winding engine. Find the tension on the rope?

Answer.—

$$\text{Tension} = \frac{80 \times 2240 \times 1}{60} = 2986.6 \text{ lbs.}$$

DEVELOPMENTS IN MACHINERY

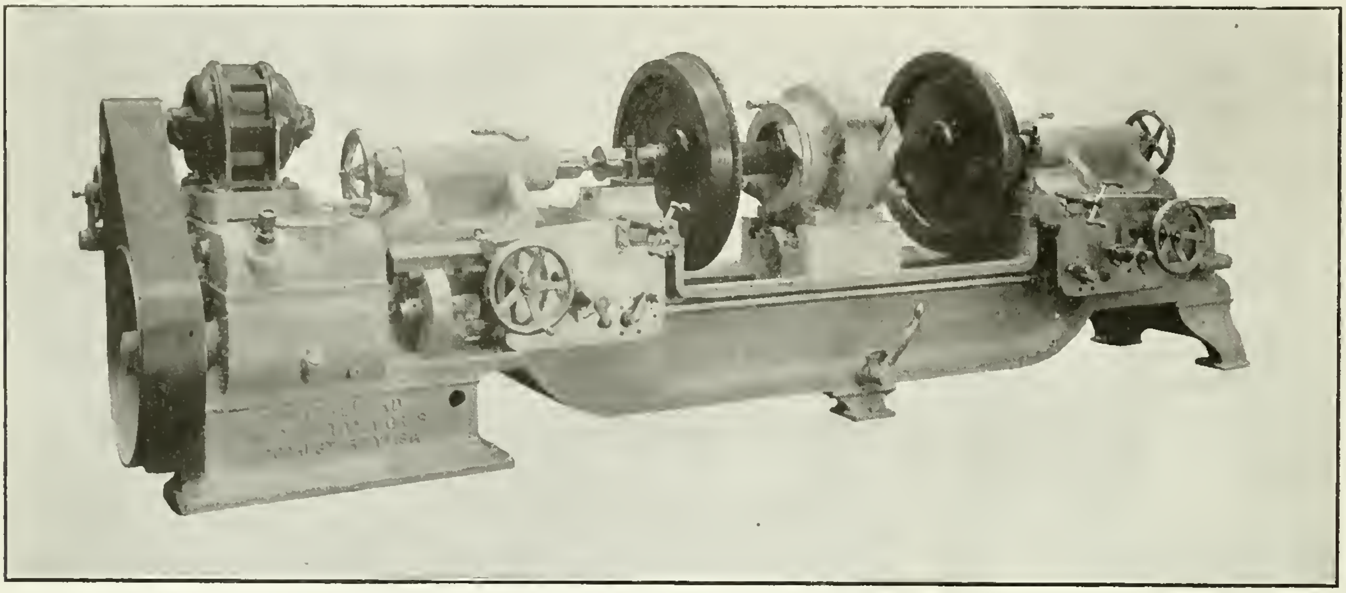
A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

"BRIDGEFORD" CENTRE DRIVE GAP AXLE LATHE.

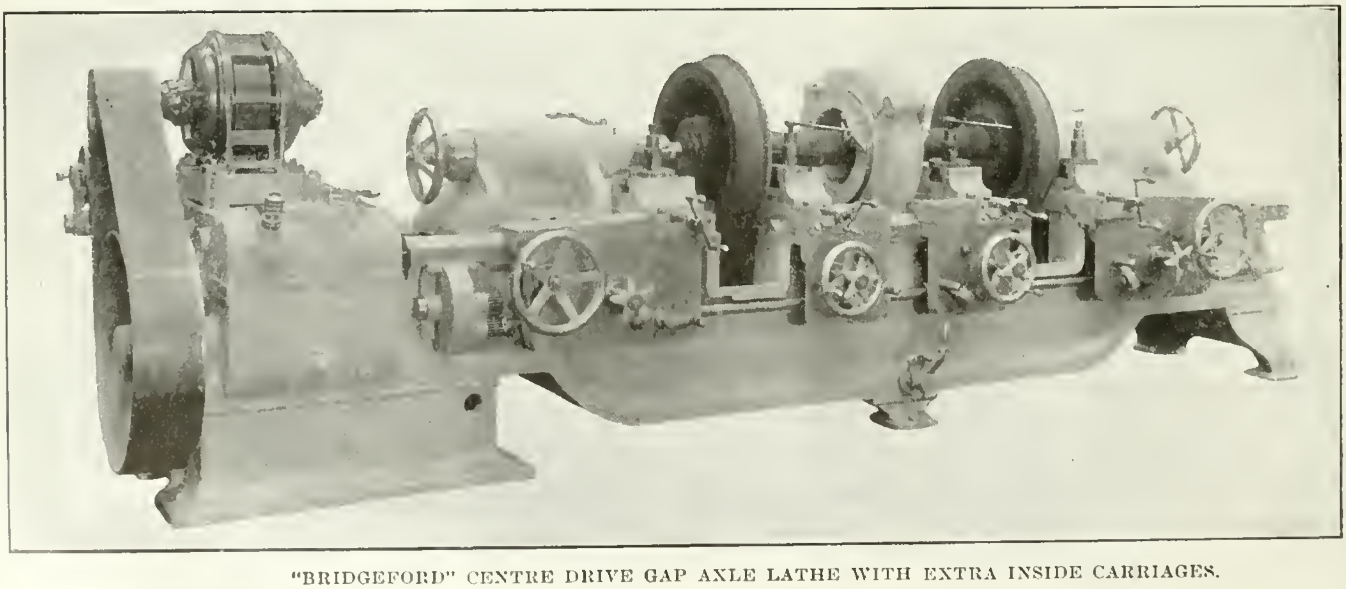
THE illustration shows a centre drive gap axle lathe with two carriages, a machine especially designed for use in railroad shops where it is desired to turn the journals of car axles without removing the wheels, thereby saving considerable time and expense. As the machine is equipped with two carriages, both ends of the axle may be refinished at the same time. The construction is similar to the Bridgeford regular line of axle lathes. It is usual for this machine to be placed in a pit so that the axles with the wheels attached can be placed on the centres with little trouble.

The driving head is powerful and of heavy construction. The driving gear, two pitch, 5-in. face, is entirely encased and runs in heavy bronze bearings scraped to fit, and is furnished with drivers for driving the axle. These operate on the same principle as the self-centering steel driver furnished with the Bridgeford regular axle lathes. The driving gear is in two pieces, of tongue and groove construction, bolted together by four heavy hinge bolts and nuts, easily operated by means of a large socket wrench. Less than one-half turn of each nut is all that is necessary to release the gear so that it may be opened to allow the entrance of the wheels and axle. The upper half of the driving head operates on a heavy hinge stud placed in front of the machine. To lift, the pull pin is pushed in place and the nuts are released. An eye bolt is placed on the upper half of the head and to this can be attached a rope with weights operating through sheave wheels to lift and lower the head.

Power is applied to a constant speed pulley. There are three variations in



"BRIDGEFORD" CENTRE DRIVE GAP AXLE LATHE.



"BRIDGEFORD" CENTRE DRIVE GAP AXLE LATHE WITH EXTRA INSIDE CARRIAGES.

the cutting speed, obtained by a speed variator through heavy cut steel gearing running in oil, and the bearings are so constructed as to receive ample lubrication. The changing of speed is accomplished my shifting levers conveniently located on the case. The power is transmitted from the speed variator to the driving head by a shaft placed within the frame. All driving shafts are of high carbon steel and run in brass boxes scraped to fit.

There are four instantaneous changes of feed ranging from 1-16 in. to 3-16 in. per turn of the axle, obtained through a feed box. The gears, which are steel, run in oil and are operated by a lever placed in the centre of the lathe. The tail stocks have a bearing on the bed of 24 inches. They are secured in position by four heavy bolts and binders. The spindles are adjustable by means of screws and handwheels and are clamped with split binders.

The carriages are driven by splined feed shaft, through rack and pinion. The direction of the feed is changed at the apron, the carriages being independent of each other. The carriages have a bearing on the vees of 30 in., which are scraped to fit. The carriages also have a bearing on the back of the bed which takes up the forward thrust, thus overcoming the tendency to raise them from the vees when the burnisher is used.

The rack is of steel, 15-18 in. wide, 6 pitch; while the feed shaft is 1 15/16 in. diameter. The bed is rigidly constructed, being strongly reinforced with cross ties of box pattern.

The distance between centres is 54 in. minimum, and 105 in. maximum respectively; the swing over the ways is 27 in., over the carriage, 13½ in., and in the gap 45 in. The centres are tool steel, 2 7-16 in. diameter.

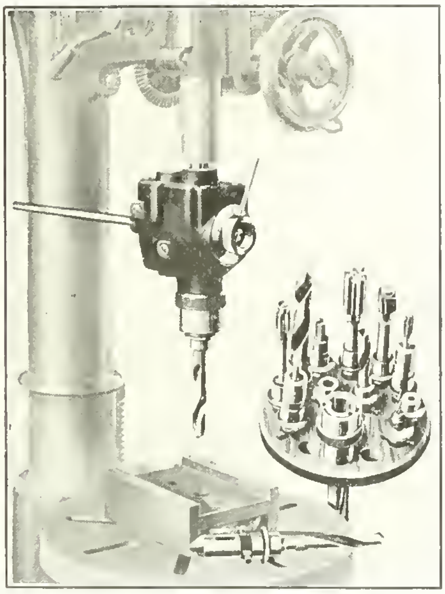
The driving pulley is 30 in. diameter for 8 in. belt, and the countershaft carries a pulley corresponding to the driviing pulley on the lathe, also tight and loose pulleys, 24 in. diameter for 10 in. belt. The loose pulley is brass lined and the hangers self-oiling.

In the case of motor driven machines the motor is either placed on top of the speed variator case as shown in the cut or driven through gears. In the last instance, the motor is placed on a base in connection with the cabinet leg of the machine. Two extra inside carriages for the refinishing of locomotive and tender axles with inside bearings are provided, and when so equipped the machine is very complete for any axle repair work which may be necessary on car, engine or tender truck axles. A swing of 55 inches in the gap can also be arranged to accommodate trailer truck axles.

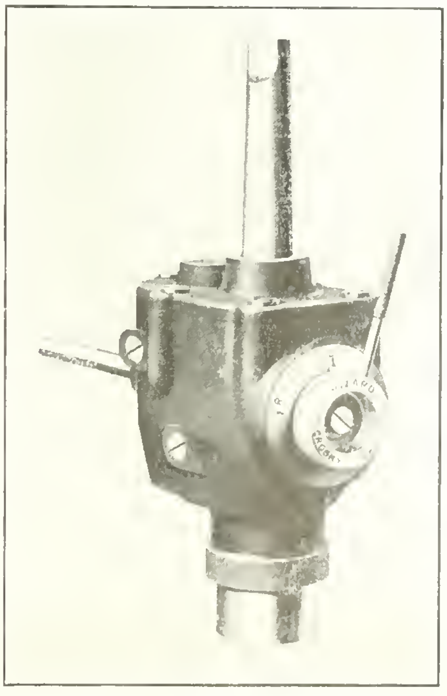
The weight of lathe with two carriages is 16,000 lbs. net, and with four carriages, 18,000 lbs. net.

DRILL CHUCK WITH VARIABLE SPEED AND REVERSING ATTACHMENT.

SIMPLICITY and strength are noteworthy features of the chuck and collets here illustrated. The chuck consists of only two main parts—a driving body with Morse taper shank to fit the drill press spindle, and a slotted collar to hold the collet up in the driving body. This collar is held on the driving body by a large hardened headless screw, and contains the long coiled music-wire spring that keeps the collar in closed position. A thin sleeve is also screwed over the slotted portion of the collar merely to cover up the slots and screw. To take off the collar, it is necessary first to remove this sleeve. These chucks are hardened and ground all over, inside and outside, while the collets are drop-forged, machined, hardened and ground. The whole collet is one solid piece of steel.



"WIZARD" CHUCK WITH VARIABLE SPEED AND REVERSING ATTACHMENT.



VARIABLE SPEED AND REVERSING ATTACHMENT.

The operation of the chuck is instantaneous and simple. A slight resistance to the collar with the hand, while the spindle is in motion throws the key slot in the chuck open, so that the collet will either fall out or slip into the slot. The spring within then throws the collar back to closed position, closing the key slot and locking the collet in place. Thus, a touch to the collar releases one tool and another tool is inserted with another touch. The motion of the spindle itself does the work.

The variable speed and reversing attachment has been designed to complete and perfect the above described chuck. It furnishes a variety of speeds for the different tools, and a reverse for tapping, etc. By a slight turn of the knurled knob, accomplished with the small knurled handle or lever, it is possible to have instantly any one of three speeds forward and a reverse. For example, should you wish to use in succession a small drill, a large drill, and a tap on the same job, the chuck and collet feature would of course make it easy to change from one tool to the other without stopping the machine, and the variable speed and reversing feature would give you a high speed for the small drill, an intermediate speed for the larger drill, a slow speed for the tap, and a reverse with quick return for backing out the tap.

The McCrosky Reamer Co., Meadville, Pa., are the designers and manufacturers of the above mechanisms.

The Polson's Ironworks, Ltd., Toronto, launched on March 4th the first of six steel scows being built for the Quebec Harbor Commissioners. The ice alongside the ways had to be broken up by means of dynamite. The scows are 144 feet long, and have a beam of 42 feet, with a carrying capacity of 500 cubic yards, and are to be used in connection with the Quebec harbor improvements. An order from the Dominion Government for a third steel steam lighter for the Hudson's Bay terminal at Port Nelson has been received by the Polson's Ironworks, Ltd. The vessel will have a length of 120 feet over all and a beam of 21 feet 6 inches, with a 10-foot draught, and is to be delivered at Port Nelson by July 1st, one month later than the two other vessels on hand, which are to be ready at the opening of navigation. The securing of these boats will obviate any further difficulty such as that experienced last year through vessels being unable to lighter their cargoes for lack of proper facilities, and through the impossibility at present of docking large vessels at the port.

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PRINCIPAL CONTENTS.

MISPLACED CREDIT.

WE read the other day of the triumph of a certain city over a public utility corporation doing business within its borders, in the matter of a point of law relative to the privileges granted to and the conditions to be observed by the latter. Credit, of course, was generally given the city's representative in the person of its legal luminary for the successful outcome of the court proceedings. It transpires however, that other and at least equally zealous champions of the city's welfare had carefully scouted the battle ground of the opposing party, and had so trained their guns and developed their plan of attack that in any case victory was inevitable. In other words, the opposing party hadn't a leg to stand upon in their contention, therefore, consummate forensic ability counted for little in the successful result.

We are inclined to think that there is a strong tendency in every sphere of enterprise and endeavor to misplace credit—a failure "to give honor to whom honor is due." It seems to be part of our general make-up to conclude that he is the hero who bears away the spoils of victory, and that they who blaze the trail are but insignificant conveniences and, therefore, of no account. We are so superficially intelligent as to be unable to discern otherwise, and, may we add, so stupidly content, as to desire to remain so. In every sphere of human endeavor and enterprise, social, commercial, industrial, political and religious we give credit to individuals in a collective or unit capacity for compassing some scheme for the general moral uplift, for the completion of some great railroad or transportation undertaking, for the inauguration of some movement which makes for the welfare and safety of workpeople in our factories, for the stand on some question of national policy by a political party which a more or less selfish interest most probably instigated, and for the unification of Christendom by the adoption of one creed and one set of doctrines, yet, are oblivious, the while, to the fact that we and many others also took a part in the game.

Some people would have us believe that to-day in commercial and industrial enterprise "the race is to the swift and the battle to the strong only." Those who dispense this line of wisdom are, however, either of the silver-spooned birth variety or of the semi-invalid type, who have never known what it is to earn a living or who have had a hand-picked portion placed at their disposal by some interested spirit. The misplacing of credit is both a crime and a curse, robbing as it does the deserving of their birthright and bringing ultimate discredit and ruin on its originators and the recipients. The oft quoted statement that "there is honor among thieves" has no existence in fact, and never had, else we would have more honor to our credit as individuals, as a community, and as a nation, and have fewer thieves. In like manner if we properly allocated the credit due each individual either in his craft or in his citizenship, there would not only be a greater co-operation and unity of interest, but a disappearance of that suspicion of motive and enmity bred of distrust.

In all business enterprise there are to be found two classes of employees—the producers and the non-producers, and it goes without saying that the former get the credit, if that happen to be a feature, and the latter are either ignored or are reminded of their uselessness, although unfortunately necessary existence on the payroll. Diagramatically and by ofttimes reiterated address and writing we are informed that direct personal touch with and tab on all the employees of our large manufacturing concerns is kept and that a magnetic influence emanating from the peak of the organization draws worthy character and service thereto. We are also told, and examples are quoted and multiplied, of men who neither would nor could be kept down in their ambition to rise to high place, but we are without record of those who failed, not because of their lack of the qualities necessary, but purely on account of a misplacement and in many cases through the appropriation by others of the credit due them.

Only the other day, to quote an example dealing with a topic which is filling a large place in the Canadian political and industrial world at the present time, viz., the application for Government assistance by the C.N.R., there was being widely circulated the report that the C.P.R. was exerting its powerful influence to oppose the desired financial help. Rightly or wrongly the latter railroad management were being so credited, and only when the highly significant words of the C.P.R. president were given voice to "that it was not the C.P. (Canadian Pacific), but the **Canadian People** who were in opposition to a further grant to the C.N.R., was it apparent that here was another obvious case of misplaced credit. In this instance, it was a desire to save its face on the part of the Canadian people and its representative Government.

It exemplifies misplacing credit by blaming another, and differentiates only from that in which another's reward is purloined. The baneful effects are the same however, in each case.

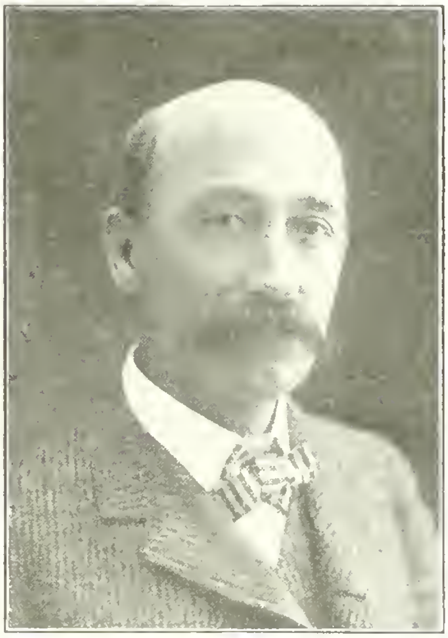
INDUSTRIAL NOTABILITIES--No. 25

THE McClary Manufacturing Co., with headquarters at London, Ont., and branch establishments in leading cities of the Dominion, occupies through its products in Canadian hearts and homes a place equally prominent with that of its purely relative industrial importance.

John McClary, London's Grand Old Man, in his declining years, is necessarily less of the active and guiding spirit in the enterprise which he founded and fostered, yet, notwithstanding, development and achievement still go on, and to the ability and capacity of his lieutenant, the subject of this sketch, W. M. Gartshore, vice-president, who through four decades has been connected with the McClary Co., the credit is in large measure due.

William Moir Gartshore was born at Dundas, Ont., in 1853, being the son of John Gartshore, manufacturer of engines, boilers, mill supplies, etc., who supplied the first compound marine engine on the lakes, and the engines for the first waterworks system of the City of Hamilton, Ont. The latter engines are, we believe, still in operation.

Mr. Gartshore received his education in Dundas and at the hands of Dr. Tassie, of Galt, Ont., following which he entered the employ of the Toronto Car Wheel Foundry in 1870, and remained there three years. He was superintendent of the London Car Wheel Foundry from 1873 to 1876, in which latter year he became associated with the McClary Mfg. Co., advancing with its growth and development to his present position of vice-president and general manager.



WILLIAM MOIR GARTSHORE

In matters military, Lieutenant-Colonel Gartshore has a record of 34 years with the Canadian Militia, occupying the various intermediate ranks up to Brigade Commander. He saw active service as Major of the 7th Fusiliers in the North-west Rebellion of 1885, and was in command of the 1st Hussars for 8 years.

The spotlight of public life does not appeal to the subject of our sketch, a period of two years' service as Alderman of the City of London, Ont., having satisfied his thitherward inclinations. Notwithstanding this, he by no means stands aloof from the active performance of works of mercy, being always ready to bear a man's part in the prevention and alleviation of human suffering.

As a consequence, we find him chairman of the Board of Trustees, Victoria Hospital; president, St. John's Ambulance Society, and president of the Industrial Bureau, all of London, Ont.

The "Welfare Work" department of the McClary plant at London, owes its inception to him, and no more active personal interest in its every feature is to be noted than his. The writer had the pleasure of inspecting the provision made for the employees' welfare in company with Lt.-Col. Gartshore some time ago, on which occasion it was easily apparent that his heart was in the work.

Lt.-Col. Gartshore is a Liberal in politics, but differed with his party at the last general election regarding the question of reciprocity with the United States.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3	19 50	20 00
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3	19 50	20 00
Clarence, No. 3	19 50	20 00
Jarrow	.....	23 50
Glengarnock	.....	26 00
Summerlee, No. 3	22 00	.....
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1	19 00	18 35
Victoria, No. 2X	18 75	18 10
Victoria No. 2 Plain	18 50	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh	$20 00
Open hearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	24 00
Wire rods, Pittsburgh	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.00
Steel bars, f.o.b., Toronto	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal	2.10
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails		75 per cent.
Pressed spikes, 5/8 diam., 100 lbs.		2 85

BOILER PLATES.

	Montreal.	Toronto.
Plates, 1/4 in., 100 lbs.	$2 30	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 60	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1 1/4 in.	9 50	9 00
" " 1 1/2 "	9 50	9 00
" " 1 3/4 "	9 50	9 00
" " 2 "	9 00	8 75
" " 2 1/2 "	11 15	11 50
" " 3 "	12 10	12 50
" " 3 1/2 "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7 1/2
Coach and lag screws	75
Plate Washers	45
Machine bolts, 3/8 and less	65 & 10
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4 1/4 per lb off
Nuts, Hexagon, all sizes	4 1/2 per lb off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright	85, 10, 7 1/2, 10, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7 1/2, 10 p.c. off
Wood screws, flathead, bronze	70, 10, 7 1/2, 10 p.c. off

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in.	75%
Finished Nuts over 1 in.	72%
Semi-Fin. Nuts up to 1 in.	72%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	13 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
1/8 in	$ .05 1/2	1/8 in	$ .12	1/2	$. 32
1/4 in	.06	1/4 in	.07 1/2	3/4	.35
3/8 in	.06	3/8 in	.07 1/2	1	.37
1/2 in	.08 1/2	1/2 in	.11	1 1/4	.52 1/2
3/4 in	.11 1/2	3/4 in	.15	1 1/2	.65
1 in	.17 1/2	1 in	.22	2	.91
1 1/4 in	.23 1/2	1 1/2 in	.30	2 1/2	1.37
1 1/2 in	.27 1/2	1 1/2 in	.36 1/2	3	1.86
2 in	.37	2 in	.50 1/2	3 1/2	2.30
2 1/2 in	.58 1/2	2 1/2 in	.77	4	2.76
3 in	.76 1/2	3 in	1.03	4 1/2	3.26
3 1/2 in	.92	3 1/2 in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4 1/2 in	1.27	4 1/2 in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	.....	...	.....
10 in	3.50	....	.....	....	.....
10 in	4.12	....	.....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
1/4, 3/8 in.	64	49	....	....
1/2 in.	69	58	....	....
3/4 to 2 in.	73 1/2	63 1/2	....	....
2 in.	....	....	69 1/2	59 1/2
2 1/2 to 4 in.	73	63	72	62
4 1/2 to 6 in.	....	....	73	63
7, 8, 10 in.	....	....	67 1/2	56 1/2
X Strong P. E.				
1/4, 3/8 in	56 1/2	46 1/2	....	....
1/2 in.	64	54	....	....
3/4 to 1 1/2 in.	68	58	....	....
2 to 3 in.	69	59	....	....
2 1/2 to 4 in.	....	....	66	56
4 1/2 to 6 in.	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
1/2 to 2 in.	43	33	....	....
2 1/2 to 4 in.	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload	$16 00	$15 75
Electrolytic copper	15 75	15 25
Casting copper	15 00	15 00
Spelter	5 25	5 25
Tin	40 50	41 00
Lead	5 15	5 30
Antimony	8 50	8 50
Aluminum	21 00	19 00

SHEETS.

	Montreal.	Toronto.
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4.30	4.10
Queen's Head, 28 B.W.G.	4.40	4.20
Fleur-de-Lis, B.W.G.	4.20	4.20
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.40	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal	0.22
Pure turpentine	0.69
Linseed oil, raw	0.60
Linseed oil, boiled	0.63
Plaster of Paris, per bbl	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., March 9, 1914.—An under-current of improving trade seems to be making itself gradually felt, though there are no very easily read surface indications of better times being at hand. However, business men, generally speaking, seem to think that by the end of April a big improvement will be seen.

The Dominion Bridge Company and the Phoenix Bridge Company have both got plenty of work on hand at present; but at nearly all the other large local industrial plants things are very quiet. The Angus shops of the C.P.R. have been on short time now for several months and we are informed that there is no present prospect of a resumption of normal working hours.

Several representatives of car-building companies have been seen at Ottawa during the past week and rumor says that the Intercolonial Railway is contemplating placing further orders for rolling stock. While railway earnings, especially in the West, have been showing a marked decrease as compared with 1913, tonnage on the Intercolonial has been well maintained. Large quantities of pulpwood are awaiting shipment at all stations along the Quebec section of the road and the present rolling stock of the road is said to be fully employed. Owing to the scarcity of orders on hand at present, the car builders would doubtless be able to quote attractive prices just now.

In the metal market there is a good volume of business being done in sheets, prices remaining firm. There is also a good demand for light plates. With regard to pig iron, dealers report but few inquiries. However, generally speaking, foundries are fairly busy and their stocks of pig on hand can scarcely be large enough to carry them on much longer. Stocks of British pig in warehouse are now very low and few orders for the opening of navigation have as yet been placed.

Tin is down ½ cent per lb. this week, while copper remains unchanged.

Toronto, Ont., March 10, 1914.—Very little improvement can be reported over last week as regards the general state of the market. The conditions affecting business, as a whole, have not changed in any marked degree, although a slight improvement in some lines may be expected in the near future.

This improvement noted above, refers more especially to the machine tool business, which, although quiet, shows distinct signs of a revival, indicated more or less by the number of inquiries being received by dealers. The number of orders booked during last week shows an increase over previous weeks although they refer generally to single machines. No large inquiries seem to be about, the uncertain condition of the money market being no doubt indirectly responsible. We understand that the Woodstock Concrete Machine Co., have placed an order with a local house for a shaper and drill.

The demand for tool steel and machine shop supplies is fairly good, although the orders that are being placed, are as a rule only for very immediate requirements.

Dealers in structural shapes, bars, etc., report conditions as being quiet with little improvement to be expected in the immediate future. Prices in the States show a continued tendency to stiffen and slight advances may be expected there in the near future, which will no doubt affect the local market. Few orders are being booked and stocks are becoming light, firms only buying to cover immediate requirements. We understand that some firms are endeavoring to place orders for future delivery at current prices, but the mills are not inclined to accept business on these terms. This, together with the increased tonnage being produced at the mills in the States, indicates that an advance in prices may be looked for. Pig iron is quiet, and no upward movement in prices can be expected meantime.

The metal market is quiet and no great change is anticipated. Prices are firm except for tin, which has weakened, being quoted at $41.00.

OCEAN FREIGHT RATES.

"This is the biggest issue in the life of Canadian trade and commerce today," said O. B. Wood, of Hamilton, at the Associated Boards of Trade meeting a few days ago in urging that the Government take action to reduce ocean freight rates. "The combine which controls ocean freight rates is the greatest and most iniquitous in the world to-day. It is driving wheat out of the country to be milled, for the reason that 8¾ more cents is charged for flour than wheat. The life of trade and commerce is being sapped, but this is not an age of slavery and serfdom and the remedy is in sight.

"I would suggest that the Government spend $5,000,000 in establishing a line of steamers to combat the high rates."

The resolution under discussion was: "That the Ontario Boards of Trade strongly urge the Government to immediately appoint a commission for the purpose of investigating the excessive charges in ocean rates and to take further action which will result in the appointment of a permanent commission with power to control and regulate such rates?"

The original resolution was changed to read that "Whereas the report of the commission shows that there is a combine, we urge that the Government establish a line of ocean freight boats."

GOVERNMENT 1914 ESTIMATES.

Ontario estimates, other than Toronto, for public works and harbors and rivers, exclusive of revotes, as tabled in the Commons on Jan. 29, are as follows; in each case the amount being for a "public building" unless otherwise specifically stated:

Acton, $20,000. Aurora, $25,000, Aylmer, $30,000.

Barrie, drill hall, $25,000, Berlin, $50,000. Bracebridge, $30,000. Brantford, $20,000. Brantford, new drill hall, $75,000. Burford, $20,000, Burk's Falls, $20,000. Brussels, $25,000.

Campbellford, $20,000. Collingwood, $75,000.

Dunnville, $20,000. Durham, $25,000. Eganville, $28,500. Elmira, $37,000. Exeter, $15,000.

Forest, $20,000. Fort Frances, $25,-000. Fort William, custom house and examining warehouse, $125,000. Fort William, drill hall, $30,000.

Galt, drill hall, $35,000. Gananoque, postoffice, to complete, $8,000. Georgetown, $20,000. Gravenhurst, $20,000. Grimsby, $15,000.

Hamilton, enlargement and improvements to public buildings, $50,000. Hamilton, postal station "B," $5,000. Hanover, $25,000. Hespeler, $25,000. Huntsville, $20,000.

Ingersoll, public building addition, $15,000. Ingersoll, drill hall, $15,000.

Kemptville, $15,000. Kingston, R. M. C. covered drill hall, $15,000. Kingston ordnance store buildings, $10,000. Kingsville, $20,000.

Lakefield, $20,000. Lindsay public building improvements, $20,000, Listowel, drill hall, $20,000. London, postoffice building, $100,000.

Midland, $25,000. Millbrook, $20,000. Milton, $20,000. Milverton, $20,000. Morrisburg, $20,000.

Napanee, drill hall, $25,000. Newmarket, $20,000. New Hamburg, $10,-000. Norwich, $20,000.

Orillia, public building, additional, $30,000. Ottawa, departmental buildings, fitting, etc., $75,000. Ottawa, new drill hall, $50,000. Owen Sound, drill hall, $50,000.

Palmerston, $20,000. Parry Sound, $20,000. Pembroke, drill hall, $35,000. Perth, $25,000. Peterborough, $50,000. Port Arthur, drill hall, $100,000. Port Arthur, custom house and examining warehouse, $80,000. Preston, $43,000.

Seaforth, $5,000. Shelburne, $50,000. Southampton, $20,000. Steelton, $30,000. Sudbury, $100,000.

Tilbury, $5,000.

Uxbridge, to complete public building, $4,000.

Walkerville, $35,000. Wallaceburg, $25,000. Watford, $20,000. West Lorne, $20,000. Weston, $10,000. Wiarton, $20,000. Windsor, drill hall, extension, $25,000.

Total, $4,247,245.87.

Harbors and Rivers.

Cobourg, harbor improvements, $50,-000. Collingwood, harbor improvements, $75,000. Fighting Island (Detroit River), improvements of channel, $57,-000. Gananoque, wharf, $18,000. Goderich, harbor improvements, $120,000. Hamilton, harbor improvements, $100,-000. Kingston, harbor improvements, $150,000. Oshawa, harbor improvements, $50,000. Owen Sound, harbor improvements and repairs, $50,000. Peterborough, dry dock, $25,000. Picnic Islands, improvement of channel, $100,000. Port Dover, harbor improvement, $50,000. Port Hope, harbor improvement, $30,000. Portland, wharf, $5,000. Port Stanley, harbor improvement, $105,000. Sarnia, wharf and shelter basin, $50,000. Sault Ste. Marie, harbor improvement, $100,-000. Thornbury, harbor improvement, $17,500. Trenton, harbor improvement, $76,000. Victoria, harbor wharf, $16,000. Wellington, wharf and harbor improvement, $35,000. Whitby, harbor improvement, $11,000. Windsor, landing dock and improvements, $40,000. Total, $2,-178,178.

What Toronto Gets.

Harbor improvement, $1,000,000 (including $860,000 previously voted.

Custom house and Postal Station A, $500,000.

Military building, $220,000.

Postoffice, Queen and Saulter streets, $100,000.

West Toronto postal station in Ward 6, $50,000.

Dominion building, $12,000.

North Toronto postal station, $4,500.

Postoffice, Spadina avenue and Oxford street, $75,000.

Total, $1,961,500.

PROBLEM OF THE THRUST BEARING.

HENRY T. NEWBIGIN in a recent paper read before the Institution of Civil Engineers, drew attention to the inefficiency of thrust bearings as compared with journal bearings and their disadvantages, especially in high-speed machinery. A comparison was made between Coulomb's laws of friction and the late Professor Osborne Reynolds's hydrodynamic theory of lubrication, and coefficients of friction in bearings of various forms were given, while the way in which the friction in a journal bearing changes from dry or greasy friction to perfect lubrication as the speed increases was also discussed. The late Beauchamp Tower's discovery of liquid pressure in the oil-film was described.

Viscosity was defined, and the resulting general formula compared with the results of Mr. Tower's and Professor Goodman's experiments. The conditions necessary for the maintenance of liquid pressure in an oil-film were also examined and defined.

The subsequent developments of Reynolds's hydrodynamic theory of lubrication were referred to, and A. G. M. Michell's formulae for the resistance of lubricated plane surfaces were cited: the paper concluding with description, illustrations and the results of tests of thrust bearings constructed on Michell's principle.

Book Reviews

The D'Este Steam Engineers' Manual, with Electrical Appendix by Charles Penrose, 448 pages, 4½ x 7 in., 240 illustrations, with four plates. Full leather binding gilt edges. Published by the Julian D'Este Company, Boston, Mass. Price $2. This is an exceedingly useful handbook for practical power plant engineers, covering both the mechanical and electrical ends. The book is arranged in two parts, the first containing 138 pages and dealing with the mechanical side, while the second part called the Electrical Appendix and written by Charles Penrose, contains 351 pages, and is devoted to the practical end of electrical engineering. In the first part the mathematics which would be useful to a steam plant engineer, are dealt with briefly. Succeeding chapters are devoted to the theory of steam, care of steam boilers, evaporative tests, pump data, strength of and power transmission by shafting, strength of riveted points and boiler shells, etc. Descriptions of plant equipment are given, covering mechanical stokers, measurement of mechanical energy, belting, and the steam engine indicator, while other chapters deal with valve setting, mechanical refrigeration, etc., and conclude with a number of mathematical tables. The introductory chapters of the second part are devoted to a discussion of electrical units, electrical measurement and the fundamental features of the operation of dynamo electrical machinery. Later chapters deal with temperature measurement by electrical means, photometry and a synopsis of present day electrical equipment of alternating current generating stations. In connection with this chapter there is an interesting folding chart showing the layout of the equipment employed and the relation between the various units. Other chapters contain illustrations of modern generating sets, high tension equipment and distributing switchboards. The three other folding charts show respectively the layout of a steam plant and the connection between the various units employed; sectional view of a steam electric generating station, and a connection diagram of a typical hydro-electric generating station. The book contains a large number of illustrations and diagrams, the reading matter is clear and well arranged, and the covers are attractive, being of leather.

T. B. F. Benson, naval architect, of Toronto, has been appointed Lloyd's surveyor for the Lake Ontario and Collingwood districts.

ASSOCIATION AND PERSONAL

A Weekly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Machinery Circles

F. H. Anson has returned to Montreal from Chicago.

C. B. Gordon, of Montreal, has been elected president of Penmans, Ltd.

James Carruthers and J. W. Norcross, of the Canadian Steamship Lines, were in Ottawa recently.

C. Hamilton-Wickes, His Majesty's Trade Commissioner for Canada, has been in Ottawa recently.

Oscar B. Mueller, president of the H. Mueller Mfg. Co., Sarnia, Ont., has been elected president of the Board of Trade for that town.

Superintendent Halfyard, of the Canadian Buffalo Forge Co., Montreal, visited Toronto last week on his way to Berlin, Ont.

F. Orr Lewis, of Vickers, Ltd., and Lewis Bros., Montreal, sailed for Canada last Saturday. Mr. Lewis has been in the Old Country on a business trip.

Captain Joseph Wiggins, a captain of vessels on the Upper Lakes in the old days, died in Toronto on March 5 in his ninety-first year. He was born in that city.

L. P. Packard, manufacturer of the boot blacking bearing his name, died in the General Hospital, Montreal, after a lingering illness. He was born in Boston in 1839.

G. W. Ross, chairman of the Montreal Harbor Commission, and Mr. F. W. Cowie, chief engineer, are now at Marseilles on a tour of inspection of the principal European ports.

C. E. Jenney, city passenger and ticket agent of the Grand Trunk, Toronto, has been appointed general agent passenger department, Vancouver, to succeed Mr. Duperow.

W. J. Moffatt, travelling passenger agent, Grand Trunk Ry., with headquarters at Toronto, has been appointed city passenger and ticket agent, Toronto, succeeding Mr. Jenney.

Thomas H. Mawson, the English landscape architect who has been in Vancouver several times doing work for the park board, has been commissioned by the King of Greece to remodel parts of the famous city of Athens.

Captain William McIlwain, Government examiner of master and mates, died in St. Catharines on March 2, aged 87 years. Deceased was Government examiner for twenty-two years.

H. J. Glaubitz, general manager of the Water Commission, London, Ont., has been given five weeks' leave of absence by the board. He intends making a trip to his old home in Germany.

W. E. Duperow, general agent Grand Trunk Ry. passenger department, Vancouver, has been made assistant general passenger agent of the Grand Trunk Pacific, with headquarters at Winnipeg.

WHO'S WHO.

W. ATTWOOD.
Manager Pump Department, Rawden Machine Co., Toronto.

S. R. Joyce, ticket clerk in the Toronto city ticket office, Grand Trunk Ry., has been appointed travelling passenger agent, with headquarters at Toronto, succeeding Mr. Moffatt.

President Taylor and Vice-president Franz, of the Lake Superior Corporation, returned on March 3, from New York, where they had been in attendance at the regular monthly meeting of the corporation directors.

W. W. Janney died at Galt on March 7, aged 61. Mr. Janney was associated with the Shurley Dietrich Co., Saw Works since its inception, and for many years acted as general superintendent of the factory. Latterly he became a member of the company.

A. Butze, for sixteen years general purchasing agent of the Grand Trunk system in Montreal, died at St. Louis, Mo., aged 68. Mr. Butze retired from the Grand Trunk System in January, 1912, and had since that date occupied a similar position with the National Steel Car Co., Hamilton, Ont.

MEETING OF THE CANADIAN MINING INSTITUTE.

THE Canadian Mining Institute held its sixteenth annual meeting on Wednesday, Thursday and Friday of last week at the Ritz-Carlton Hotel, Montreal.

The annual report of the council made special reference to the meeting of the International Geological Congress in Canada last year. While the institute was not officially responsible for the conduct of the meeting, the organizing and directing committees were composed almost entirely of officers and prominent members of the institute, and the success of the Congress redounded to their credit. The membership for 1913 was 1,029, or 6 less than in 1912, the slight decrease being due to the reduced membership of the affiliated student societies at McGill and the Kingston School of Mining. The treasurer's report showed receipts of \$18,575 in 1913, including a bank balance of \$5,295 at the beginning of the year. The disbursements were \$12,907. These reports were adopted.

The following officials for 1914 were elected:—

Past Presidents—Dr. W. G. Miller, Toronto; Dr. F. D. Adams, Montreal; Dr. A. E. Barlow, Montreal.

President—G. G. S. Lindsey, Toronto.

Vice-Presidents—Thos. Cantley, New Glasgow, N.S.; Charles Fergie, Montreal; W. F. Sutton, Victoria, B.C.; A. A. Cole, Cobalt, Ont.

One of the most interesting addresses was that delivered on the first day of the meeting by Dr. Edward D. Peters, professor of metallurgy at Harvard, the title of whose paper was "The Production of Heat in Metallurgical Furnaces." Other interesting papers were read by Mr. F. D. Reid on "Milling Practice in Cobalt," and by George A. Guess, Toronto, on "Pyritic Smelting."

A large number of delegates attended the meeting, which was one of the most successful yet held by the institute.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Berlin, Ont.—The Rutenber Co., are building a factory for the manufacture of automobile engines.

London, Ont.—The Cook-Fitzgerald Co. have obtained permission from the council to extend their power plant.

Hamilton, Ont.—The Dominion Chain Co. are building a factory for manufacturing chains. Machinery will be required.

Edmonton, Alta.—A contract for drilling for gas near Viking was signed by the Edmonton Industrial Association on March 5, at $10.50 per foot.

Quebec, Que.—An auxiliary power unit has been purchased by the Quebec Daily Telegraph. The unit consists of a 50-h.p. gas engine and generator.

Port Arthur, Ont.—It is stated that if the Government would grant a bonus on iron ore mined in Canada a local syndicate would establish a steel plant here.

Edmonton, Alta.—It is reported that an eastern company manufacturing automobiles are negotiating for a site in the Village of Beverley, where they will erect a factory.

Winnipeg, Man.—A site has been purchased at St. Boniface by the Wm. Galloway Co., who contemplate the erection of a plant to manufacture agricultural implements.

Vancouver, B.C.—It is reported that the Phoenix Mfg. Co., Eau Claire, Wis., will build a factory for manufacturing tractors, gas-electric engines. J. S. MacDonald is interested.

Berlin, Ont.—The Berlin Light Commission is calling tenders for a 350,000 cubic feet gasholder, 2-lift telescopic type, and steel tank. John Keillor, consulting engineer, Hamilton, Ont.

Ingersoll, Ont.—It is considered probable that Wilson & Short, of Detroit, will purchase the Standish Manufacturing Co.'s plant, and install equipment for manufacturing automobile specialties.

Sault Ste. Marie, Ont.—Mr. J. Frater Taylor, president of the Lake Superior Corporation, announces that they have been authorized to borrow $2,500,000 to enable them to proceed with extensions under way.

Hamilton, Ont.—A sewage pumping station and extensions to the Trolley Street plant, which will cost $110,000, will be started this spring.

Vancouver, B.C.—A site has been purchased on Burrard Inlet by the Imperial Oil Company, who will build an oil refinery at a cost of approximately $500,000. Work on the buildings will commence shortly.

Thorold, Ont.—Voting on a by-law will take place on April 2 to grant concessions to a syndicate who are proposing to build a plant for the manufacture of abrasives. Mr. James Battle is interested.

Vancouver, B.C.—DuCane, Dutcher & Co., engineers, have applied to the city council for a franchise to build a central heating plant. In connection with this application City Engineer Rust has submitted a report.

Orillia, Ont.—Alex. Grant, chief engineer of the Trent Canal, has sent the Water, Light and Power Commission copies of the plans for the work at the Swift Rapids, including the new power house for the town.

Englehart, Ont.—A proposition has been submitted to the town council by Mr. K. Farah regarding the development of High Falls. Mr. Farah is owner of the Charlton-Englehart Power Co., and is prepared to expend $400,000 on the development of the Falls.

Guelph, Ont.—The Canadian Products, Ltd., have purchased the plant of the Standard Fitting and Valve Co., on the York Road, which has been lying idle for some time The president of the new company is W. B. Hinman, of Cleveland, Ohio, and he is associated with a number of business men of that city. The new company has beeen incorporated with a capitalization of $100,000. It will manufacture high carbon steel structural tubing. New machinery has been ordered.

Electrical

Calgary, Alta.—Tenders are being called for two 3,000 k.w. transformers.

Kingston, Ont.—The Board of Trade are urging the city council to conclude arrangements with the Hydro-Electric Commission for securing cheap power for the city.

Ford, Ont.—The council have decided to use Hydro-electric current for the street lighting system.

St. Mary's. — Mayor Butcher and Councillor Bartlett visited London on March 5, to attend the Hydro Radial Convention.

Simcoe, Ont.—The present contract for street lighting expires in July, so the council are considering the question of opening negotiations with the Hydro-Electric Commission.

Blenheim, Ont. — Blenheim wants hydro-electric service. Mayor J. B. Smith has written to Hon. Adam Beck, and a public meeting is expected to be held soon to consider the proposition.

Walkerville, Ont.—Mr. Murphy, manager of the Walkerville Light & Power Co., has been requested to make an inventory of the property of the company as a preparation for the sale to the Hydro Commission.

Ottawa, Ont.—For the first time in history the Government here has been in direct telegraphic communication with Port Nelson by wireless to the Pas, and thence by a land line to Ottawa. The message was received on February 23.

Sudbury, Ont.—The Fire, Water and Light Committee are considering the advisability of installing water meters in all industrial and public buildings on account of the large amount of water wasted annually. C. F. Carmichael, chairman.

London, Ont.—Westminster Township Council sent to the Ontario Power Commission a petition from ratepayers asking for estimates on hydro-electric power. Farmers of the township desire to make use of Niagara power in agricultural and daily work.

Windsor, Ont.—At the Sandwich council meeting on March 3, with Reeve McKee in the chair, a contract was submitted by the Essex County Light & Power Co., asking the council to give its approval. It was considered too complicated to handle, however, and was referred to the town solicitor.

Burford, Ont.—Burford ratepayers, on March 9, carried by 28 majority a by-law enabling the municipal council to enter into a contract with the Hydro-Electric Commission for Niagara power, and also a money by-law providing for erection of a distributing station and

equipment. The number of votes polled was 95.

Quebec, Que.—Professor Herdt, of McGill University, who has been investigating the lighting system of the Dorchester Electric Company on behalf of the City of Quebec, will present his report to the council in a very short time, and it is likely that a number of changes will be necessary to perfect the lighting of the city's streets.

Toronto, Ont.—The Provincial Hydro-Electric Commission is advising the Toronto Hydro-Electric Commission to acquire the plant of the Interurban Electric Co. of West Toronto for $280,000, in which is included $180,000 for physical assets, and $100,000 for the intangible assets. The gross business of the company is estimated at $85,000.

Aylmer, Ont.—At a meeting to consider guaranteeing the bonds of the London and Lake Erie Traction Line extensions to Aylmer and Sparta, an agreement was reached that the matter be referred to the people, and a vote taken on it. Aylmer's total was reduced from $40,000 to $30,000, and the sum Malahide will be asked to vote is $20,000. St. Thomas and Yarmouth will have the balance to make up.

Strathroy, Ont.—At a meeting of the town council a by-law authorizing the borrowing of $25,000 by the sale of debentures to provide for the cost of a plant to distribute electric light and power supplied by the hydro-electric power commission was passed. A by-law to provide for the supply of water and electric light free of charge to, and the fixing of the assessment of, the Canadian Handle Manufacturing Co. was passed.

Kincardine, Ont. — Mayor Mitchell and Reeve Hunter have interviewed the Hydro-Electric Commission with reference to power for this section of Bruce County. The chief engineer promised that a price per horse-power would be given some time in June. The scheme is to hook up the Saugeen and Eugenia Falls with Niagara power. The mayor said that what Bruce County towns want was electric power to place them upon an equal footing with other manufacturing centres.

Contracts Awarded

Ottawa, Ont.—The Dominion Government has awarded a contract for six 200-ton mechanical coaling plants to Roberts & Shaeffer Co., Chicago, Ill.

Winnipeg, Man.—A contract has been let to the Northern Construction Co. to build a railway from Winnipeg to Shoal Lake. The railway will be 65 miles long, and cost $500,000.

Municipal

Preston, Ont.—The town council are considering making extensions to the waterworks system.

Calgary, Alta.—City engineer G. W. Craig has submitted to the city council alternative plans for a bridge over the Bow River.

Weston, Ont.—It is proposed to raise a sum of money for the purpose of advertising the town in the Toronto daily papers. A publicity agent will be appointed.

Hamilton, Ont.—The city has secured a more favorable rate from the Hydro-Electric Commission for the operation of the waterworks pumps at the Beach station.

Windsor, Ont.—City Engineer Brian thinks that Windsor should have an incinerator plant. The latter cannot be operated economically on less than fifty tons a day.

Hamilton, Ont.—It is announced that the city wil call tenders for equipment for the fire department, which will include a gasoline tractor, ladders and a quantity of hose.

St. Lambert, Que.—The town have sold bonds to the value of $480,000 for the completion of the sewage system and side walks. Street lighting equipment will also be required.

Stratford, Ont.—The city council are considering the question of installing an incinerator. Ald. D. A. McLachlin is chairman of a special committee appointed to look into the matter.

Brockville, Ont.—The draft agreement between the town council of this place and the Morrisburg Electric Railway Co. has been prepared and will be taken up by the council this week.

Sault Ste. Marie, Ont.—At a recent meeting of the city council the advisability of installing an incinerator was discussed at some length and laid over to be taken up again at a future date.

Moose Jaw, Sask.—The city is contemplating installing a distributing system for natural gas. Georgeson & Co., have submitted a proposition to furnish gas to the city at 20 cents a thousand feet.

Kingston, Ont.—The city council will probably make application to the Ontario legislature for permission to put a by-law to the people for raising $24,000 for the purchase of land at the outer station to be held for industries.

Sarnia, Ont.—The Board of Trade has decided to raise $5,000 to finance a publicity campaign. A publicity commissioner will probably be employed. Oscar B. Mueller is president of the Board of Trade.

Thorold, Ont.—It is announced that a company has purchased a site here and will erect a factory. A by-law will be voted on April 2 to grant the necessary concessions. No further particulars are at present available.

St. Thomas, Ont.—A committee composed of Mayor Johnson, Chairman Horton and Ald. Meehan has decided to purchase a fire truck at a cost not to exceed $4,000. Two men will be added to the permanent staff of firemen at a salary of $60 a month.

Wingham, Ont.—At the regular meeting of the Wingham town council on March 2, the report of the electric light committee was adopted that debentures be issued for $2,500; $1,500 for line extension and $1,000 to complete work of installing new machinery at the electric light power house.

Windsor, Ont.—Ratepayers of Windsor voted on March 3, in favor of three industrial by-laws. The concerns benefited are: The Central Ice & Storage Co., a newly-organized concern, which will manufacture artificial ice on a large scale; the Ideal Concrete Machine Co., and the Dowsley Spring & Axle Co. All of these will be granted the usual exemptions.

Hamilton, Ont.—The following tenders have been recommended to the city council by the Board of Control. Brass fittings—H. Mueller Co., Sarnia, $3,639; hydrants—Canadian Allis Chalmers Co., Toronto, $49 each; castings—Hamilton Foundry Co., $1.85 per 100 pounds; iron pipe—Gartshore-Thomson Co., Hamilton, $31.50 per ton; lead pipe—Tallman Brass Co., $6 per 100 pounds; pig lead—Tallman Brass Co., $4.85 per 100 pounds.

Toronto, Ont.—Parks Commissioner Chambers has been instructed by the Parks Committee to make a report upon a bridge across the Don connecting the two sections of Riverdale Park. Two schemes have already been prepared, one costing $50,000, and the other $30,000, the Parks Commissioner favoring the latter proposition. He will supply full details of both proposals at the next meeting of the committee, when the aldermen will pass upon them.

Montreal, Que.—Two new 12-million gallon pumps are to be bought by the city at once, and other improvements are to be made to the pumping system which will cost $144,000. A report to that effect was submitted to the city council on March 4th by the Board of Control. The

items in the report are: For a conduit to supply the new pumps, $25,000; two 2-million gallon pumps and boiler building, $85,000; two boilers, $24,000; and a new brick chimney and connections, $10,-000; making a total of $144,000.

Montreal, Que. — Another step towards the completion of the city's new filtration plant at Point St. Charles, was taken on March 4, with the opening of tenders before the Board of Control, for contract No. 4, comprising pump house and other buildings for the plant. The tenders were referred to the chief engineer for report. The contractors and tenders were: F. J. Jago Co., alternative prices, $155,000 and $159,-500; A. G. Loomis & Son, $174,000 and $170,000; Norman Macleod, $193,000, and $199,000.

Kingston, Ont.—The Board of Trade is still endeavoring to get the city council to secure cheap power to induce industries to locate here, believing the city's industrial future depends almost entirely upon its ability to supply cheap power to manufacturers. The board recently passed a resolution calling upon the city council to make a strong effort at once to secure power from the Hydro-Electric Commission and to base the estimate of consumption on such reasonably optimistic figures as may insure a fairly cheap rate.

Victoria, B.C. — Estimates for the Public Works Department brought down on Feb. 26, in the Legislature amount to $5,316,575, and include the following: Works and buildings, $2,319,500; roads, bridges and wharves, $2,861,000; subsidies for steamboats, $96,075; roads and bridges, Delta, $25,000; Dewdney, $77,-000; Point Grey, $20,000; Chilliwack, $37,000; Richmond, $140,000; Second Narrows bridge, conditional re-vote, $400,000; Chilliwack ferry, $8,000; Lytton ferry, $480; Mission ferry, $8,000; Hope ferry, $3,600; Pitt river, $900.

General Industrial

Listowel, Ont.—The Dry Powder Mill Co. will build a factory here.

Prince Albert, Sask.—F. Frank will probably build a fertilizer factory here.

Vancouver, B.C.—The Cascade Laundry Co. contemplate making an addition to their building.

Parry Sound, Ont.—Wm. Taylor, sen., has decided to use electricity in the operation of his tannery.

Carbon, Alta.—Mr. Colfas has purchased the electric light plant from A. Reid, and is running a chopper in connection.

Toronto, Ont.—Another fire occurred recently at the tannery of Wickett & Craig. The loss is estimated at $2,000.

Quebec, Que.—A factory building occupied by the Quebec Waist and Clothing Co. was badly damaged by fire on March 4. The loss will be about $1,000.

Princeton, B.C.—The B. C. Portland Cement Co. will probably make a large addition to their plant, which would double the capacity.

Montreal, Que.—Forty factories have been affected by the emptying of the Lachine Canal, and many of them will be compelled to run reduced staffs because of loss of power developed by the canal.

Toronto, Ont.—It is reported that the Toronto Terminal Co. is being organized to build and operate the new Union Station. It is stated that the company are negotiating for property around the present station.

Sarnia, Ont.—The Sarnia Fence Co. has agreed to turn over its entire Western business to the Grain Growers' Grain Co., which will pay an agreed price per ton for the output of the factory, and will retail it.

Redcliff, Alta.—P. J. Hogan, of Montreal, representing the United Shoe Machinery Co., arrived here last week and is now engaged in setting up the machinery in the shoe factory. He will be here about two weeks and will see the plant started.

Coquitlam, B.C.—Representatives of Canada Sabulite Co., Ltd., are negotiating a site for a plant to manufacture explosives. The company has factories in London (Eng.) and Belgium, and will start building as soon as negotiations are favorably concluded.

Estevan, Sask.—Leases for oil and gas rights on nearly 17,000 acres of land in the vicinity of Estevan have been taken out at the Dominion Land Office, and preliminary arrangements are being made for the formation of a company capitalized at $250,000.

Lethbridge, Alta.—C. S. Farrow, proprietor of the Lethbridge Steam Laundry, has ordered a modern filtration plant from the Kennicott Co., Chicago. This will provide against impure water, which nearly put the laundry out of business during the freshet season last spring.

Guelph, Ont.—It is reported that the Dominion Linen Mills, which have been closed down for several months, are about to resume operations. The property, it is understood, has been sold to a syndicate of Toronto gentlemen. A full staff of workmen will be employed, and there is plenty of capital behind the deal.

Uxbridge, Ont.—The piano factory is starting operations. Messrs. Osborne, Sortis and Bone are here, and in a few days the works will be in running shape. The prospects for a successful industry are very bright, and when mild weather comes, additional buildings will be erected.

Tisdale, Sask.—The Tisdale Trading and Knitting Co. will establish a manufacturing industry in this town. This decision has been arrived at owing to the building of the government railway from Le Pas to Port Nelson, and the fact that Tisdale is the nearest established farming district to that northern part.

Orillia, Ont.—Negotiations have been concluded between the town and J. R. Eaton & Sons regarding a loan to the company for the erection of a factory. A by-law will be submitted to the ratepayers on March 30, to ratify the agreement. Under the contract, the town agrees to loan the company $50,000 repayable in 20 years and also offers a number of other privileges.

Guelph, Ont.—H. O. Taft, Canadian general manager; Mr. Byers, Canadian superintendent; and Mr. Fisher, head of the London (England) office, all connected with the Libby, McNeil & Libby Co., of Chicago, were in the city and lost no time in formally taking over the building which the company is to occupy here, the papers all being signed and sealed on March 5.

Ottawa, Ont.—J. W. Curran, of Sault Ste.-Marie, Ont.; Mayor Lyons, of Steelton, and Cyril Young of North Bay, have been in Ottawa interviewing the Government regarding assistance in the production of ore, in order to put the steel industry on its feet. In 1913 they state that there was only one ton of Canadian ore used in Canadian blast furnaces out of every 22½ tons used.

Vancouver, B.C.—Work on the large factory to be erected by the Barber Mattress Co. on False Creek, flanked by the G.N. tracks and by Parker and Napier streets and Glen drive, has already begun. When completed, the work of the three factories at present run by the company will be concentrated in the four-storey structure to be built on the new site, according to statement by Mr. Barber.

N.T.R. Shops, St. Malo, Que.—We are advised that work on the foundations of the N.T.R. shops at St. Malo Que., is proceeding steadily, and that tenders for the boilers and power house equipment will be called within the next two or three months. Tenders for machine tools will not be called within at least a year from date, and the completion of the shops will probably not be realized until the Fall of 1916.

Toronto, Ont.—Pollay Brothers, of Belleville, will remove their plant to Mimico, Ont., where they will build a factory for making aeroplanes.

Windsor, Ont.—A tender has been received from the Toronto Furnace and Cremating Co., for a 25-ton incinerator to cost $24,000. The matter is under consideration by the council.

Owen Sound, Ont.—The Doric Cement plant will be sold by auction on April 6. It is reported that a syndicate will buy the plant and operate it during the coming season.

Edmonton, Alta.—Harry V. Shaw, president of the Edmonton Cigar Co., will erect a warehouse and factory building. Magoon & Macdonald, architects.

Montreal, Que.—Daly & Mortin, Lachine, Que., manufacturers of curtain fixtures and moldings, plan to make alterations and improvements in their plant.

Medicine Hat, Alta.—The International Supply Co., Ltd., manufacturers of gas and oil well drilling supplies, will increase the output of its plant. W. R. Martin is managing director.

St. John, N.B.—It is reported that the Sanford Barrel & Keg Making Co., will establish a plant here with a daily capacity of 5000 barrels. It is said that the company will build a chain of factories in Canada. Charles L. Sanford is president.

Montreal, Que.—Plans are being prepared for a new paint factory for the Martin-Senour Co. W. B. McLean, 204 St. James St., is architect. It is said that bids for the construction of the building will be asked about Mar. 1.

Guelph, Ont.—Cowan & Walker have been awarded the contract for the erection of the factory to be used by Sherer & Gellett, of Chicago, counter manufacturers. The new factory will be started at once, and will be situated at the extreme eastern end of the city, close to the C.P.R. and the street railway.

Ottawa, Ont. A deputation from Western Ontario recently called on Hon. W. B. Nantel, Minister of Inland Revenue, to draw his attention to the necessity of something being done towards the purification of natural gas. A great number of complaints have been made lately about the offensive smell of the gas in Ontario.

Oil Springs, Ont.—The Fairbank interests, drilling for gas about 300 feet south of the Oil Springs Oil and Gas Co.'s workings recently, struck a strong flow at 1,900 feet. When the drill reached that depth the cuttings were blown out and water forced clean over the top of the 60-foot derrick. A. E. Sullivan, of Brantford, is the contractor, who has been working for the Fairbank Company. This well is turning out two million feet of gas a day, and looks as if it might be a permanent producer.

Building Notes

Victoria, B.C.—The Victoria Curling Club is proposing to build a large rink. The cost of building and plant is estimated at $25,000.

Windsor, Ont.—On the casting vote of the mayor, authority was granted by the city council on March 2nd to submit a by-law for the erection of a new market building at a cost of $70,000.

Port Arthur, Ont.—It has been decided to call tenders, award the contract and commence the construction of the new county jail here as soon as the frost is out of the ground. The building will cost about $100,000. The city by-law submitted will give $75,000, and the government has granted $25,000 to its construction.

Wood-Working

Welland, Ont.—A site has been purchased by the Welland Lumber Co., who will build a sash and door factory.

Eganville, Ont.—A sawmill will probably be built here by the Standard Chemical, Iron and Lumber Co., of Toronto.

Quebec, Que.—A sawmill belonging to Joseph Bouchard, at St. Jerome, St. Paul's Bay, was completely destroyed by fire on March 9. Loss, $5,000.

Redcliff, Alta.—The Redcliff Woodworkers have started their planing mill again. This plant has been shut down all winter.

Sudbury, Ont.—The saw mills and office of Foley Bros., at Foley's Lake, have been completely destroyed by fire. Practically nothing was saved.

Kingston, Ont.—At the annual meeting of the Board of Trade on March 3, F. R. Phillips, of Toronto, representing the Reliance Moulding Co., Ltd., addressed the board with regard to moving his plant from Toronto. A by-law was passed last year.

Ottawa, Ont.—The Fraser Mills, above Deschenes, near Aylmer, Que., belonging to J. B. Fraser, of Ottawa, will shortly close down, and several hundred men will be thrown out of work. The reason for the closing of the mills is the fact that the company intends to move the plant up to the Hurricanaw district, near Cochrane, on the Transcontinental line.

Bathurst, N.B.—The Bathurst Lumber Co., of Bathurst, N.B., announce that they have completed plans for the erection of a fifty-ton sulphite pulp mill at Bathurst. Work on this undertaking is to be started at once, organization having been completed. The mills will be operated under the name of the Bathurst Pulp & Paper Co., Ltd., with a capitalization of $3,000,000. Angus McLean, general manager of the Bathurst Lumber Co. will be president of the new concern, while A. G. McIntyre, editor of the Pulp and Paper Magazine and superintendent of the Forest Product Laboratories, a recent graduate of McGill University, will be the manager.

Refrigeration

Windsor, Ont. The Central Ice & Cold Storage Co., Ltd., is asking the city of Windsor for the usual exemptions and not for free water to make ice. They want only such exemptions as are granted to any manufacturing concern. J. H. Green, manager.

Windsor, Ont.—The new plant which the Central Ice & Cold Storage Co. will build, will be five stories high, of steel and concrete construction. The building will be 800 x 150 ft., and will have a storage capacity of 500,000 cub. ft. The estimated cost of buildings and equipment will be $150,000.

Coquitlam, B.C.—The Coquitlam Ice Co., on Dewdney Trunk Road, contemplate extending their plant, and work is to commence immediately on a new ice house on the rear of the establishment. The added building will cost in the neighborhood of $400.

New Incorporations

The Eureka Rubber & Tire Co., Ltd., incorporated at Toronto, capital $40,000, to manufacture rubber goods at Toronto. Incorporators: John L. Reid, Tom Metcalf, etc., Toronto.

The Port Sydney Land & Mining Co., Ltd., incorporated at Toronto, capital $100,000, to acquire, and develop mines and mineral lands. Incorporators: James Stables, George Alexander, etc., Toronto.

The St. Johns Machinery & Tools Co., Ltd., has been incorporated with a capital of $45,000, and will establish a plant at St. Johns, Que., to manufacture tools of various kinds. Provisional directors are: O. Bard, E. Patenaude, A. N. Deland and others, all of St. Johns, Que.

Shea Sales Co., Ltd., incorporated at Ottawa, capital $50,000, to import, export, and otherwise deal in machinery, etc., at Montreal. Incorporators: John J. Creelman, Gilbert S. Stairs, etc., Montreal.

North Woods Mines, Ltd., incorporated at Toronto, capital $40,000, to acquire, and develop mineral lands and deposits. Incorporators: Gideon Grant, Mervil MacDonald, etc., Toronto.

William Cowlin & Son, Canada, Ltd., incorporated at Toronto, capital £10,000, to carry on the business of builders, contractors, at Toronto. Incorporator: Sydney V. Kendall, Toronto.

The Canadian Peat Co., Ltd., incorporated at Toronto, capital $250,000, to manufacture and deal in peat fuel, and clay products of all kinds, at Toronto. Incorporators: Hugh P. Bell, Michael Chapman, etc., Toronto.

United Motors, Ltd., incorporated at Toronto, capital $50,000, to carry on the business as manufacturers of automobiles, motor trucks and motor vehicles, at Toronto. Incorporators: James J. Kenney, Lloyd C. Loomis, etc., Toronto.

The Keystone Electric Co., Hamilton, Ont., has been incorporated with a capital stock of $75,000, to manufacture automobiles, gas engines, steam engines, etc. Henry A. Burbidge, John R. Marshall, incorporators.

The Motor Finance Co., Montreal, has been incorporated, with a capital stock of $50,000, to manufacture automobiles, engines, etc. Adolphe Kornbloom, New York, N.Y.; Edwin N. Todd, Edwin A. Mumford, incorporators.

Refractory Ore Converters, Ltd., incorporated at Toronto, capital $150,000, to acquire, and develop mines and mineral lands at Hamilton, Ont. Incorporators: James W. Lamereaux, John J. Markham, etc., Hamilton, Ont.

Canadian Union Metal, Ltd., incorporated at Toronto, capital $40,000, to manufacture metal porch columns, and metal furniture, etc., at Galt, Ont. Incorporators: Don C. Barrick, Charles H. Barrick, etc., Canton, Ohio.

The Farrell Engineering Co., Ltd., has been incorporated at Toronto, with a capital of $40,000, to carry on a contracting and engineering business at North Bay, Ont. Incorporators—Cecelia Farrell, J. Bain, Mr. Stewart, of North Bay.

The Windsor Power Bldg. Co., Ltd., incorporated at Toronto, capital $100,000, to construct buildings and to do a general warehousing and storage business, at Windsor, Ont.; Incorporators: Benjamin J. Fox, James A. Straith, etc., Toledo, Ohio.

Tenders

Ottawa, Ont.—Sealed tenders addressed to the Secretary of the Department of the Interior, Ottawa, Ont., will be received up to noon, 6th April, 1914, for the supply of 13,500 lineal feet of 20-in. diameter lapwelded steel pipe, and 12,000 lineal feet of 6-in. diameter cast iron pipe for the water system at Banff, Alta. Specifications may be had from the Commissioner of Dominion Parks, Ottawa, Ont.

Railways—Bridges

Goderich, Ont.—Steps are being taken to influence the Provincial Legislature to renew this charter of the Ontario West Shore Railway, which expires on April 13.

Ottawa, Ont.—A bill respecting the Sudbury, Kippewa and Bell River Railway has been passed by the Dominion Railway Committee. It will run from Temiskaming Lake to Bell River on the N.T.R.

Moncton, N.B.—It is reported that plans for a new steel bridge to replace the present wooden structure across the Petitcodiac River at Moncton are being prepared by the Public Works Department at Fredericton and are nearing completion.

London, Ont.—McAllister, Beer & Co., representing Detroit, Montreal and New York capitalists, will apply for a charter to build a new $3,000,000 radial line from London to Grand Bend on Lake Huron and from there to Stratford, and eventually take in Woodstock, Guelph, Galt, Toronto and St. Catharines.

Lambton Mills, Ont.—Divisional Engineer Hertzberg, of the Canadian Pacific Railway, has prepared plans for the enlargement of the overhead bridge spanning the Humber River near here, in order to lay an additional track at this point. This will make a through double track line to Islington.

Toronto, Ont.—Corporation Counsel Geary states that the Private Bills Committee of the Federal Parliament had deferred consideration of the application of the Toronto, Niagara and Western Railway for an extension of time in which to construct their railway in the city limits. The application is likely to be dealt with next week. It is being opposed by the city.

Winnipeg, Man.—Contracts for four bridges, costing between $3,000,000 and $4,000,000, have been let by the C.N.R. These bridges, which are all on the main line west of Edmonton, are over the Snaring, Miette, Athabasca and Pembina Rivers. The substructure of concrete for the first three bridges is now under construction, and it is expected that the steel will be erected during the summer. All these bridges will form part of the Canadian Northern Transcontinental permanent lines.

Granby, Que.—A new railway to be known as the Farnham & Granby Ry. Co is to be built from Farnham through the counties of Brome and Rouville to the town of Granby, Que., and then northeasterly passing through the counties of Shefford to Windsor Mills or Richmond, P.Q., with power to connect with the C.P.R. and the Central Vermont Railway. This is the purport of an application for an Act to incorporate, presented to the Canadian Parliament. This railway will pass through a fertile district of Quebec Province.

Marine

Sarnia, Ont. — A large number of steamers are being fitted out here and at Port Huron for the coming season.

Toronto, Ont.—It is rumored that James Playfair is organizing a company to compete with the Canadian Steamship Lines, on the Great Lakes.

Quebec, Que. — The Galway-Quebec Steamship Service Scheme is tied up for the present, as the provisional directors decline to subscribe more capital until more outside support is assured.

St. Catharines, Ont.—St. Catharines Board of Trade have passed a resolution asking the Dominion Government to deepen the whole St. Lawrence route so that ocean-going vessels can come right to Central Ontario.

Goderich, Ont.—Under Government supervision the lighthouse here is being partially demolished to accommodate a revolving flashlight which the Dominion Government has decided to place there.

Kincardine, Ont.—A big delegation from the town council and Board of Trade left for Ottawa recently to urge the Government to make a real harbor of refuge here and prevent any more big wrecks.

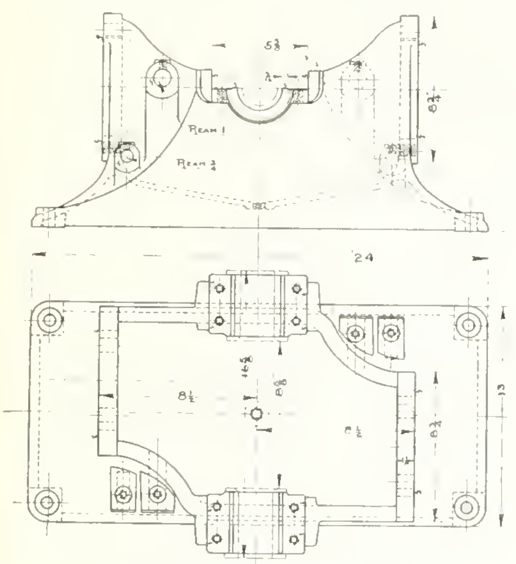
Halifax, N.S.—Plans to build a large drydock are being prepared in this city by the Public Works Department, and surveyors have been sent to determine the exact location of the big dock. As soon as the site is selected, work will at once be commenced and the construction rushed with all possible speed.

Machine Design from the Manufacturing Standpoint

By D. O. Barrett, M.E.

Although dealing specifically with the manufacture of a range of sizes of gasoline engines, this article indicates at the same time, a line of procedure adopted to achieve a definite purpose, and while it may necessarily differ in its detail for the quantity output of other products, there is nevertheless an enunciation of basic principles, the observance and application of which are in conformity with all specialty manufacture.

IN our present day college courses great stress is laid upon machine design, that is, from the theoretical standpoint. This, together with the drawing room practice, occupies a great portion of the student's time. Strength of materials, velocity diagrams, effects of inertia, etc., are treated in much detail. These things are all right in their place and very necessary to proper understanding of certain principles, yet how many men who have gone through just that would be capable of producing a machine which, besides being simple and practical could be manufactured at a reasonable cost.



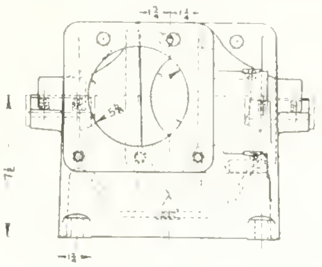


FIG. 1. DETAIL DRAWING OF BED, 6, 8, 10 H.P. SIZES.

This article will deal with the gasoline engine as a subject, yet the principles here laid down and the application of same can be used in any line of manufacture where machines are built in which the steps are not too great between the various sizes. The tendency of the present day is toward the cheaper class of engines, many of which do the work and last just as long as those whose first cost is much greater. Right here, let it be understood that the word cheaper does not necessarily apply to quality. A purchaser, nowadays, objects to paying for extra polish on an engine or for unnecessary finish of parts whose functions have no direct bearing upon its proper operation.

All the complicated and fancy designs cannot be laid at the door of freshly graduated college students, for we see on the market scores of engines which require an enormous amount of unnecessary handling to finish the heavy parts, while even the small parts are made with a variety of fancy curves which must have given the jig and tool designer a headache when they were put up to him.

While any refinement which will add to the efficiency of the engine or is a distinct improvement in some way should not be sacrificed simply for the sake of simplicity, yet it is just as easy in designing any of these parts to construct them in such a manner that they may be easily machined and handled, and this especially applies to all hand-fitting, which is always the most expensive work around any machine. Other things being equal, the simplest machine is always the most satisfactory, both as regards its operation and duration of service.

The writer was recently called upon to design a line of two-cylinder opposed engines of the hopper-cooled, or open-jacket type, and while these engines embody nothing really new and are similar in design to hundreds of others now on the market, yet the points leading up to this construction are well worth a little study and thought, not only for their application to gasoline engine design but to other branches of manufacture as well. The writer is familiar with the methods of a well-known machine tool builder whose machines are constructed along similar lines with a great saving not only in the first cost but in repairs and ease in assembling.

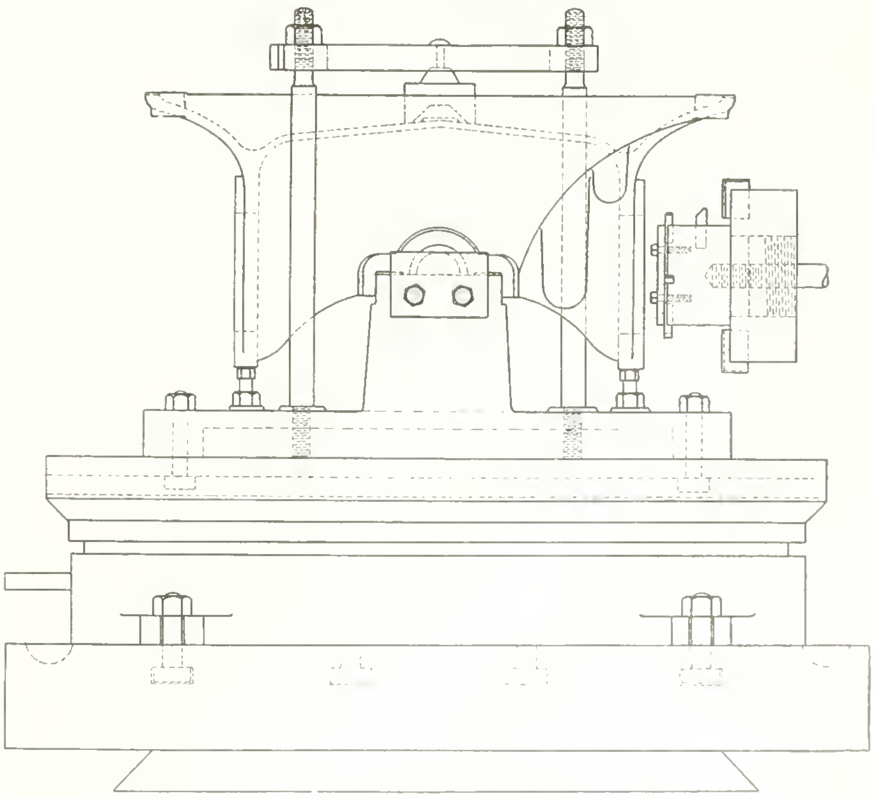


FIG. 2. MILLING THE BEDS.

This firm already had upon the market a line of standard closed water jacket engines of 10, 16 and 25 horse power but due to the increasing demand, found it imperative to bring out an engine of the hopper-cooled type. Being a small firm, and therefore limited, both as to work-

ing capital and manufacturing facilities, the desire was to keep down the number of parts, thus making the cost of patterns, jigs and tools, stock to be carried, etc., as low as possible. The sizes aforementioned had bores and strokes as follows:

Horse power.	Bore.	Stroke
10	5	5
16	6	6
25	7	7

Only the first two sizes will here be dealt with, as it was not the intention to carry the hopper-cooled sizes above 16 horse power.

A careful study was made of the situation, and it was decided to use the crankshaft, connecting rod, piston, and piston rings of the first two sizes, these being the only parts taken from the regular line. The following sizes were then chosen:

Horse power.	Bore.	Stroke.
6	4	5
8	4½	5
10	5	5
12	5	6
14	5½	6
16	6	6

This gave a line of engines of sizes such as are usually demanded by farmers for whom this style of engine is especially suited. These six sizes were divided into two sets—6, 8 and 10 h.p. and 12 14 and 16 h.p. The only difference between the engines of any one set lay in the cylinder, piston, piston rings and flywheel, all the other parts being identical. The same flywheel was also used on two sizes in each set, the 8 and 10 h.p. of the first set, and the 14 and 16 h.p. of the second. Using the different flywheel on the 6 and 8 h.p. served to differentiate the two sizes, otherwise they would have been the same in outside appearances. On the 10 h.p., where the same flywheel was used as on the 8 h.p., the hopper was made higher to give it a correspondingly heavier appearance.

The Necessary Tool Equipment.

Carried along with the design of the engine was that of the tool equipment for the various parts, this being all decided upon before any of the patterns were made. Wherever a machine operation could be omitted or the design changed in any way to facilitate machining, this was done.

Fig. 1 shows a detail drawing of the bed of the 6, 8, and 10 h.p. sizes. To begin with, it will be noticed that the bed is symmetrical with respect to a centre line through the main bearings; thus there is no right or left. In fact, in assembling the engine, there was nothing to determine in which direction the engine should run until the governor and its connections were attached. The results of this will be shown in the method of machining. Stationary shafts were provided for the cam gears and rocker arms, one of each being on either side of the bed.

The Moulding Feature.

To assist the foundryman as much as possible, the bed was tapered both outside and in, there being no overhanging bosses or projections with the exception of the main bearings and the cylinder flanges. Instead of using projecting round bosses for the cam gear and rocker arm shafts, these were filled in

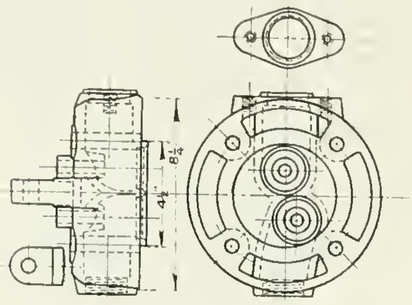


FIG. 3. CYLINDER HEAD.

below so that they would draw straight from the sand without resorting to loose pieces. Loose pieces never retain their proper position and are constantly turning up as missing, as well as having some moulder ram them up and forget to draw them. The pattern was also made much stiffer and the extra amount of iron added was nothing as compared to the probable losses the other way. The projecting parts of the main bearings were attached to a core print extending completely across the bed, this also serving to hold the pattern in its proper shape.

The pattern was rammed up to the top of this print which was then withdrawn with the projecting parts of the pattern and a corresponding core which now covered the open places inserted and the ramming continued. On turning over the cope extended down into the lower part of the base so that no cores were needed there. When the pattern was withdrawn, the only cores to set were those at the end forming the holes for the cylinders. A foot, about 1¾ inches square and about 1-32 inch lower than the bottom of the bed was left at each corner. Ordinarily these required no finishing but, should they come too rough, two men easily handled them on the disc grinder. The ideal grinder, of course, for this job, was one with a horizontal disc on which the beds could simply be set and held by gravity.

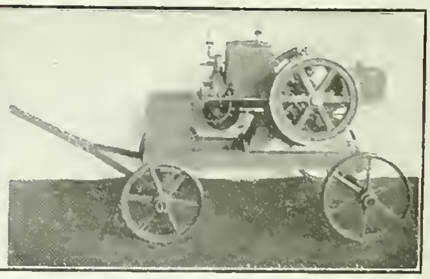
The Machining Feature.

The next operation was milling the main bearings. The beds were clamped against an angle plate with two stops bearing against the side to square them up. An end mill was then run through the bearings finishing the sides and the 3-16 inch ridge at the top of the bearings. The distance of this milling from the bottom of the bed was immaterial as no operation depended upon this; in fact everything was measured from the centre of the main bearings. The main bearing caps were also provided with a 3-16 inch ridge which was disc ground, holding same by hand, and then straddle milled to fit the bearings.

Babbitting came next, a split mandril being used and both caps and bed being poured simultaneously. The mandrel had a self-centering device bearing against both sides of the beds on the inside. The caps and beds were then drilled with respect to this babbitting so that they were all interchangeable.

Fig. 2 shows how the beds were milled. The milling machine turret on which these were done was described in detail in the Feb. 6, 1913 issue of Canadian Machinery, the distinguishing feature of which is that one lever operates both the index pin and the clamping device. The beds were turned over and placed on a fixture centrally located on the turret, fitting in the previously milled bearings. Plates bear against the ends of the babbitted bearings, one of them being provided with clamping studs. A slotted

DOUBLE CYLINDER ENGINE.



SINGLE CYLINDER ENGINE.

bar was slipped across the top with a bearing on the bottom of the oil pan and pulled down by means of the two clamping posts. To eliminate any chatter, screws were run against the beds at the ends and locked. Face milling of the ends was first done, the cutter being set from a milled surface on the fixture (not shown). After facing the one end, the

turret was indexed and the other faced.

The table was now run out and a boring head fastened directly into the face mill, being driven by means of a key and held by a rod extending through the spindle. The hole for the cylinder is $1\frac{3}{4}$ inches off the centre line of the bed and a stop was provided on the table for this position. The boring head was then run through and the 45 deg. tool at the back allowed to bevel the edge sufficiently so that the cylinders would fit up properly even though the corners were not machined clear out. The table was then run back, the turret indexed, and the opposite end bored without further setting. Both knee and saddle were provided with hinged stops, permitting the setting of the saddle and table so that, after the machine is once set up for the job, there is no measuring to be done.

While these engines have not as yet been produced in sufficient quantities to justify the expense, yet the original tool designs called for a special horizontal drill press arranged to sit on the table of the milling machine to drill, ream, and face the two holes at the side of the bed. A bracket carrying two bushings was to be placed on the fixture on either side of the bed and while the facing of the end was being done, the two holes were to be drilled and reamed through slip bushings, the holes on the opposite side of the bed coming into position when the turret was indexed. The bosses were then to be finished with facing tools provided with adjustable stop collars so as to enable them to be set once for all. In this manner, the major portion of the work on the bed would be done right on the milling machine table and at the one setting, keeping the one operator busy without losing any time. In drilling, the beds were slipped into a jig with hinge bushings for the sub-base hole, and while in this position the holes for the main bearing caps were drilled and tapped, also any other drilling or tapping. The holes for the cylinder studs were drilled under the multiple spindle press.

The engine cylinder was of conventional design as shown by the photographs. Fig. 3 shows the cylinder head which, in order to make one head answer for both ends, had the inlet opening at the top centre and the exhaust on the bottom centre. After facing the end of the head fitting the cylinder, they were slipped into a box jig and entirely completed with the exception of milling the post for the exhaust lever. Both valves were exactly the same. A cast iron manifold elbow fitted into the head, the remainder of the manifold being made of standard pipe and fittings. This manifold would go on from either side and when the engine was completely assembled could be lifted right off by simply loosening the governor connection and taking off four nuts, whereas in the old style engine it was necessary to remove the flywheel on that side, the manifold running beneath the bearing. Placing the inlet at the top of the cylinder greatly assisted in handling the heavier fuels, as these engines would run satisfactorily on kerosene, naphtha, distillate, solar oil, etc. Any fuel that was deposited in the bends of the manifold would flow down into the hot inlet passage of the head and there be vaporized.

The cam was made of cast iron, cast to exact size in an iron chill which acted, both to harden the cam and form to the proper shape. The rocker arm following the cam had a hole drilled halfway through it in which the push rod rested, the whole being held back against the cam by a spring attached to a cotter pin extending through the rod. In assembling the cam gear and rocker arm shafts are driven into the bed, the parts placed on the shafts with the washer and cotter pin at the end, and then further driven in until the washers bear up against the shoulders; this constitutes all the hand fitting on these parts. The main bearings were reamed by using a long bar carrying a reamer at either end two thousandths larger than the shaft, this bar being driven by power and the bearing caps screwed down on the reamer. The only work done on the bearings was to relieve them slightly at the sides, but no scraping was required. Babbitt bushings were used in the connecting rod bearings at the crank end with bronze at the piston end. One-quarter inch play was left at each side of the rod in the piston so as to prevent any cramping.

That portion of the cylinder head projecting into the cylinder was turned $4\frac{1}{2}$ inches on the first set and $5\frac{1}{2}$ inches on the second set. On the 4-inch cylinders the counterbore was made $4\frac{1}{2}$ inches, while the $4\frac{1}{2}$-inch cylinders were bored straight through as were also the 5-inch Of course, on the latter size the projection on the head did not touch the cylinder wall as on the first two, but no bad effects were encountered and the same head did for the three sizes. The spark plugs were placed in the side of the cylinder with the priming cocks directly above. When the engine was warm it would start even when primed with kerosene. The inspection cover over the bed carried the magneto which was driven from one of the cam gears, the coil box being placed just back of the magneto. The magneto, was of the low-tension type, but without distributer, producing a spark in either end at each revolution. One spark then occurred on the exhaust stroke and was wasted, but this helped to keep the plugs clean and also simplified the wiring, doing away with the distributer and making it impossible to get the wrong wires to the spark plugs as is the case when a distributer is used. A large opening with a cover was provided in the centre of the inspection cover so that the connecting rod bearings could be looked after without removing the entire cover.

The engine, in the two-cylinder opposed type, proved so sucessful that it was decided to make single-cylinder engines as well. These were made of the hit-and-miss type, dispensing with the carburetor and magneto, two very expensive accessories. This was necessary in order to get the selling price sufficiently low to compete with other engines on the market. The same cylinder with head complete, exhaust lever and push rod, piston and connecting rod were used on the single-cylinder engine, as well as the cam gear and pinion and the gear and rocker arm shafts and all studs. The crank-shaft was made the same dimensions in the bearings as the double-throw shaft so that the connecting rod bushings need not be changed as well as using the same reamers for the bearings and flywheels.

There were thus six sizes of engines to be made using the existing cylinders. The three sizes from the first set were constructed, but as yet the larger ones have not been, though they probably will be later. Twelve sizes of engines were obtained with a minimum number of parts, the sizes being as follows:

Horse power.	Bore.	Stroke.
2	4	5
2½	4½	5
3	5	5
3½	5	6
4	5½	6
5	6	6
6	4	5
8	4½	5
10	5	5
12	5	6
14	5½	6
16	6	6

The reason that the single-cylinder engines did not give half the power of the double-cylinder was that it was necessary to run them at a slower speed on account of the imperfect balancing. One of the greatest advantages of this construction was the appeal made to the dealer on the question of repairs as one part would, perhaps, fit six sizes of engines such as a valve, cylinder head, or cam gear, the parts most likely to need replacing. For instance, suppose John Jones had a 6 h.p. engine and Wm. Smith a 10 h.p. Jones allows one of his cylinders to freeze and burst by not properly draining same. He absolutely must have power and the dealer does not carry a cylinder and piston in stock and he cannot wait until they come from the factory. So he goes to Smith and borrows one of the cylinders and pistons from his 10 h.p. engine and, by the combination,

he now has an 8 h.p. Or he might also have borrowed a cylinder from either a 2, 2½ or 3 h.p., single-cylinder engine, and they would fit equally well.

In order to show how the various parts interchange and the really few separate and distinct parts necessary to build twelve sizes of engines, the accompanying table has been made up. Similar markings along the horizontal lines indicate that that part was used under those engines:

List of Engine Parts.

Horse Power	2	2½	3	3½	4	5	6	8	10	12	14	16
Bed	+	+	+	x	x	x	o	o	o	=	=	=
Cylinder	+	x	÷	o	—	—	+	x	÷	o	=	—
Cylinder head	+	+	+	x	x	x	+	+	+	x	x	x
Sub-base	+	+	+	x	x	x	o	o	o	—	=	=
Inspection Cover							o	o	o	=	=	=
Flywheel Gov. Side	+	+	x	o	o	÷	=	—	—	$	&	&
Flywheel Pul. Side	+	+	x	o	o	÷	=	—	—	$	&	&
Crankshaft	+	+	+	o	o	o	x	x	x	=	=	=
Conn. rod complete	+	+	+	o	o	o	+	+	+	o	o	o
Piston complete	+	x	o	÷	=	—	+	x	o	÷	=	—
Piston ring	+	x	o	÷	=	—	+	x	o	÷	=	—
Governor ball	+	+	+	x	x	x	o	o	o	o	o	o
Gov. ball collar							x	x	x	o	o	o
Governor collar							x	x	x	o	o	o
Cam gear pinion	+	+	+	x	x	x	+	+	+	x	x	x
Cam gear	+	+	+	x	x	x	+	+	+	x	x	x
Cam	+	+	+	x	x	x	o	o	o	=	=	=
Rocker arm	+	+	+	x	x	x	o	o	o	=	=	=
Rocker arm roller	+	+	+	x	x	x	+	+	+	x	x	x
Governor arm	+	+	+	x	x	x	o	o	o	=	=	=
Gov. arm bracket	+	+	+	x	x	x	o	o	o	=	=	=
Exhaust lever	+	+	+	x	x	x	+	+	+	x	x	x
Exh. lever stud	+	+	+	x	x	x	+	+	+	x	x	x
Exh. & Inlet valve	+	+	+	x	x	x	+	+	+	x	x	x
Exh. valve spring	+	+	+	x	x	x	+	+	+	x	x	x
Inl. valve spring	+	+	+	x	x	x	+	+	+	x	x	x
Push rod	+	+	+	x	x	x	+	+	+	x	x	x
Push rod head	+	+	+	x	x	x	+	+	+	x	x	x
Manifold elbow							+	+	+	x	x	x
Manifold piping							+	+	+	x	x	x
Sub-base screws	+	+	+	x	x	x	+	+	+	x	x	x
Main bear. studs	+	+	+	x	x	x	+	+	+	x	x	x
Cylinder studs	+	+	+	x	x	x	+	+	+	x	x	x
Cyl. head studs	+	+	+	x	x	x	+	+	+	x	x	x
Manifold studs	+	+	+	x	x	x	+	+	+	x	x	x
Flywheel key	+	+	+	x	x	x	+	+	+	x	x	x
Cam gear shaft	+	+	+	x	x	x	+	+	+	x	x	x
Rocker arm shaft	+	+	+	x	x	x	+	+	+	x	x	x
Carburetor	+	+	+	x	x	x	o	o	o	=	=	=
Magneto							o	o	o	o	o	o
Lubricators	+	+	+	+	+	+	+	+	+	+	+	+
Induction coil	+	+	+	+	+	+						
Tool box	+	+	+	+	+	+	o	o	o	=	=	=
Gasoline tank	+	+	+	x	+	+	o	o	o	=	=	=
Muffler	+	+	+	x	x	x	+	+	+	x	x	x
Skids	+	+	+	x	x	x	o	o	o	=	=	=
Other equipment	+	+	+	x	x	x	o	o	o	=	=	=

Illustrations are shown of both the single and double cylinder engines and it may readily be seen that nothing has been sacrificed to make either symmetrical in appearance. The writer was formerly connected with an engine firm in which the engines were all built in pairs, that is, for an 8 and 10 h.p. engine, the only difference would be in the cylinder and piston. On these same engines also, the cam gears from 6 to 20 h.p. were the same for all sizes. These are some of the most successful engines on the market at the present time and are sold in the largest quantities.

The writer has gone into this in some detail because, of course, he is more familiar with engines than any other type of machine. The same principles are, however, adopted by a good many firms other than those building engines, and are well worth some study and thought, the gasoline engine merely showing how these are applied in the design and how they are later carried out in the actual construction of the engine.

STEEL DRIVING BELTS.

WHILE engineers generally have been devoting a good deal of attention to improvements in chain and tooth gearing for transmitting power, says The Engineer, a new system of belt-driving has been introduced in Germany which appears to possess many advantages over some of its older rivals. We refer to transmission by means of steel belts on the Eloesser system.

These belts are made from a specially-hardened carbon steel having a very high tensile strength. The belts vary in thickness, and are made in widths between 1½ in. and 8 in. The tension required is determined with very minute accuracy by a special instrument, and only one flexible steel joint is used. The belts run on flat pulleys, which are covered with a composite layer of canvas and cork. They are only about one-sixth of the weight of leather belts or ropes suitable for transmitting similar powers, and there seems to be no practical limit to the speed at which they can be run.

So far, it has not been found feasible to use these belts with fast and loose pulleys, although they are suitable for employment with friction clutches. Neither is their adoption recommended for cross-belt work where the distance between the centres of the pulleys is less than eighty times the width of the belt, nor for very small pulleys, on account of the bending stresses set up. For continuous drives, however, no matter how close or distant the centres, and either horizontal or vertical, the steel belt has been applied with remarkably efficient results. It is claimed that a steel belt is only about one-third the width of a leather belt for corresponding power, that it does not stretch even with years of work, and, as there is no measurable slip, the transmission is uniform and invariable.

In order to convert pulleys from rope driving to steel belt transmission, a stout steel band is strained round the pulley rim and fastened to a plate fitted into a small cut-out section of the pulley grooves. The smooth surface thus formed is serrated and provided with a friction covering of the kind referred to above. The method of jointing consists of a special clamp mounted on the ends of special clamp is mounted on the ends of the belt, and after the required tension has been applied, the ends are threaded between an upper and lower steel plate shaped to suit the pulley profile until they abut. The clamping plates are then closed by a number of countersunk screws, and soft solder is run into the joint to prevent the screws from slackening. The edges of the belt are rounded off, so that it can be safely handled while running.

The belt is being introduced into Great Britain by the Power Pulley Co., Ltd., Union Works, Manchester, which has already fitted up several large cotton mill drives in the Manchester district on the system with excellent results.

RAIL CORRUGATION AND ITS CAUSES.

By P. W. D'Alte Sellon, M. Inst. C.E.

THE corrugation of rails has become general and serious upon railways and tramways since the introduction of electric traction, and seriously exercises the owners of such undertakings. Investigations organized by many associations in various parts of the world have neither discovered a solution of the trouble nor yet propounded any theory of the causes which has found general acceptance; nor have they suggested any remedy. The object of the paper read recently before the Institution of Civil Engineers, and from which the following abstract is taken, is to put forward the present position for discussion, in the hope that therefrom assistance towards a remedy may proceed. Large expenditure is being incurred by many tramway undertakings in grinding out corrugations, thereby shortening the life of the rails abnormally. It is estimated by the General Manager of the City of Glasgow Tramways that his undertaking spends not less than $50,000 per annum in this grinding operation.

The author is of opinion that the rail-steel now used is not hard enough or

tough enough for its work, and possibly modern methods of steel and rail-making are at fault in this direction. The use of wheels of small diameter is evidently severe on rails, but the conditions of tramway working make alteration impracticable. It therefore becomes necessary to find a material which will not yield to the wheel actions which are the immediate cause of corrugation. Hard rails—i.e., with a high proportion of carbon—are, he believes, essential, and he gives some evidence from his own and others' experience that such high-carbon rails resist the corrugating actions of the wheels, as well as ordinary wear. The British Standard specifications were established before corrugation was realized as a serious possibility, and the range of carbon content permitted, besides being rather wide, only approaches the hard side for Bessemer steel, whilst it is on the soft side for open-hearth steel.

Character of Corrugation.

The general character of corrugation is described, in the paper, stress being laid upon the facts that the "crests" have the appearance of planished or cold rolled steel, and are relatively hard and refractory to acid. The "hollows" are dull, show some lateral detrusion and pitting, and are only slightly harder than the body of the steel. The conclusion drawn is that the "crests" are cold rolled, and the "hollows" are surface which has been crushed, due to the vertical loads imposed by the wheels oscillating about the elastic compressive limit of the steel. How the oscillatory character of the load is brought about is not considered, but it is pointed out that at ordinary speeds the usual pitch of the corrugations on tramway-rails corresponds with a frequency of the order of 100 per second. The difference between this periodicity and that causing the corrugation of macadam roads by motor-vehicles is referred to. The possibility of the rails receiving initial corrugations in the processes of rolling and cooling is briefly discussed, but it is pointed out that such initial corrugation, if it ever exists, is uncommon. Differences of surface hardness or internal stresses received during manufacture are sugested as possibilities.

Leaving these suggestions, the fact remains that corrugation is due to the failure of the rail-table under the stresses imposed upon it. The surface is alternately cold rolled and disintegrated. The measurements of static pressure made by Mr. Worby Beaumont, and set out in the paper he presented to the British Association in 1911, are shown to prove that pressures of such magnitude as to produce destructive effects occur, but that it is probable that the compressive elastic limit of rail-steel is not generally exceeded. The evidence, therefore, seems to show that a comparatively small increase in the compressive strength of the steel will prevent the particular kind of wear under consideration.

Essentials Suggested.

The author suggests that the essential points to be specified are mechanical properties corresponding with the working-stresses imposed upon the rails, and first compressive strength. The British Standard specification prescribes an ultimate tensile strength of 40 tons per square inch. The compressive strength is probably about the same as the tensile, and the actual wear of tramway-rails suggests that it is somewhat in excess of 40 tons per square inch. Probably steel with an ultimate tensile strength of 50 to 60 tons per square inch will be hard enough to resist the destructive stresses, but it is essential that it shall not have a high degree of ductility. The minimum pressure needed to produce surface crushing and flowing should be determined. It is suggested that a Brinell test may give all the information needed. The tup test may have to be modified, but rails laid on a continuous concrete substructure have a large margin of safety against breakage from vertical shocks, and a less severe tup test should suffice. The whole specification of the rail in respect to its mechanical qualities should bear a direct relation to the stress which it will be called upon to resist.

THE DAVIE SHIPBUILDING PLANT, LEVIS, QUE.

GEORGE D. DAVIE, writing to the Montreal Gazette a few days ago, with reference to a report published to the effect that the Canadian Vivkers Company are negotiating for the purchase of the plant of George D. Davie & Sons, Levis, while admitting negotiations are going forward for the purchase of the plant, denies that Vickers are the parties concerned. He says that as there have been a number of reports in the public press with reference to the future of this shipbuilding plant, I would like to state once and for all that I have arranged to take over the interests of the other partners and continue the business under the name of "The Davie Company, Limited," and am now incorporating a company for such purpose. Although some new capital is going in, the plant will continue to be operated and controlled by myself.

Out of Respect.—The plant of the Canadian Westinghouse Co., Hamilton, Ont., was closed all day Saturday, March 14, out of respect for the life and work memory of the late George Westinghouse.

THE FENCING OF MACHINERY.

A REPORT has recently been prepared and issued on "Fencing and Safety Precautions for Transmission Machinery," by W. Sydney Smith, H.M. Inspector for Dangerous Trades and is a document of considerable interest.

Mr. Smith first examines the requirements of Section 19 of the Factory and Workship Act, 1901, which is concerned with the fencing of machinery in factories, and explains that these regulations are not sufficiently far-reaching. He then goes on to deal with various types of transmission machinery, namely, shaftings, couplings, collars, wheels, drums and pulleys, clutches, belts, ropes, and chains. The causation and incidents of accidents are then discussed, and taking the years 1908 and 1909, the causes of the accidents in those years are analyzed in detail. This is done by means of tables, of which the first treats of the various operations being carried out when the different accidents occurred, while the second shows the comparison between the accidents due to loose clothing, hair, etc.

It is seen that, whereas in 1908, 187 accidents (27 fatal) were attributable to these causes, there were 144 (17 fatal) which were not due to clothing, etc. In 1909 the numbers were 165 (30 fatal) and 109 (11 fatal) respectively. It is then seen that in both years the greater number of accidents were due to loose clothing and hair, the actual ratios being 56.5 per cent. in 1908, and just over 60 per cent. in 1909.

The next table sets out the points of contact at which the accidents occurred, such as shafts, collars, couplings, clutches, projecting screws, keyways, belts, pulleys, gearing, etc., and the remaining tables give information concerning the height of the shaft or other machinery causing the accidents, the occupations of the workpeople affected, and the severity of and classification of severe accidents.

Mr. Smith then goes into the question of what he considers should be done in in the way of fencing, and the taking of safety precautions for transmission machinery, and he illustrates his remarks with drawings which exemplify what should not and what should be done. These suggestions he has brought together in an appendix to his report, and it is proposed that, if adopted, they shall be eventually brought into operation as additional regulations. The formal issue of them as regulations is, however, deferred until the users of machinery and others concerned shall have had time to consider the proposals and to submit any observations which they may desire to make.

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

FLYWHEEL QUERY SOLUTION.

By "Centrifugal."

IN the March 12, issue of Canadian Machinery there appeared on page 256 an enquiry from H. Westwood as to the stresses set up in the rim bolts and hub bolts of a flywheel 12 feet in diameter, running at 150 r.p.m. and weighing 10 tons. The hub and rim are split, and the hub is held by four 2½-inch bolts, while the rim is secured by four 2-inch bolts. Mr. Westwood states that the initial stress in each of the hub bolts is 1,000 pounds and 700 pounds in each of the rim bolts.

Now, while I believe the following method of approaching this problem to be correct, I do not pretend to an expert knowledge, and hope some fellow-readers who are better up on the subject than myself will send along their solutions for publication.

Formula for Centrifugal Force.

The total centrifugal force (F) in a revolving body expressed in pounds is

$$F = \frac{W \times V^2}{g \times R}$$

Where F=Total centrifugal force in lbs.
W=Weight of revolving body in lbs.
V=Velocity of revolving body in feet per second.
R=Radius of gyration of the body in feet.
g=Acceleration due to gravity= 32.2.

The radius of gyration (R) may be taken as the mean radius of the rim of the wheel. We are not told the size of the rim; but for the purposes of this solution let us assume that the rim is 10 inches deep. Then the mean diameter of the wheel will be

144 — 10 inches=134 inches.

and since R must be expressed in feet, we have

$$R = \frac{134}{2 \times 12} = \frac{67}{12} \text{ feet.}$$

Now, the force tending to disrupt a flywheel is not the total centrifugal force (F), but is (F) divided by 3.1416. The case is analogous to that of a boiler shell. Consider a certain length (1 inch long) of a section of a boiler. The total radial forces acting on this length are clearly found by multiplying the pressure of the steam in pounds per sq. inch by the circumference of the boiler in inches, or to put it into a formula:

$$\text{Total force} = P \times 3.1416 \times D.$$

Where P=Pressure per sq. inch.
D=Diameter of boiler in inches.

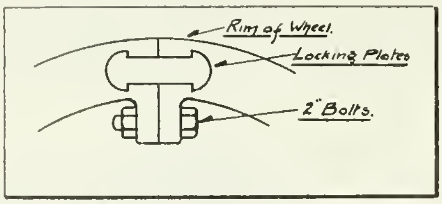
It is, however, well known that the force tending to rupture a boiler transversely is given by the expression, $P \times D$. In other words, to find the force tending to burst the boiler, we divide the total pressure by 3.1416. Similarly in the case of a flywheel we must divide the total centrifugal force (F) by 3.1416 in order to find the force tending to rupture the wheel at its diameter. Thus, the formula becomes:

$$\text{Bursting tendency} = \frac{W \times V^2}{3.1416 \times g \times R}$$

In this formula V is the velocity in feet per second of the wheel at the mean radius of the rim (R). This radius we have assumed above to be 67 inches. The corresponding diameter is therefore

$$\frac{67 \times 2}{12} \text{ feet.}$$

This circle revolves at 150 revs. per minute, and its speed per second, therefore, is



FLYWHEEL QUERY SOLUTION.

$$\frac{3.1416 \times 67 \times 2 \times 150}{12 \times 60} = 88 \text{ ft. per sec.}$$

We are now in a position to fill in the numerical values in our formula, the values being as follows:—W=20,000; V=88; R=67÷12=5.68; g=32.2.

The force tending to disrupt one-half of the wheel from the other half is, therefore,

$$\frac{20{,}000 \times 88 \times 88}{3.1416 \times 32.2 \times 5.68} \text{ pounds.}$$

=269,607 pounds, or (say) 270,000 lbs.

Assuming that the bolts have U.S. standard threads, the area at the root of the thread will be 2,302 sq. inches for a 2-inch bolt, and 3.719 for a 2½-inch bolt. The total area of the eight bolts will, therefore, be a trifle over 24 square inches, and the stress per square inch of area will be

$$\frac{270{,}000}{24} = 11{,}250 \text{ pounds.}$$

Relative Considerations.

Of course, considerable assistance will be given to the rim bolts by locking plates shrunk into the rim on both sides as shown in the sketch; but even allowing for this, it is clear that the bolts are too highly stressed. The trouble is that in the problem, as stated, the speed of the wheel is too high. The speed of the extreme outside edge of the rim is over 94 feet per second. This would be all right for a solid wheel, but for a split wheel the speed should be considerably reduced. Probably 60 or 70 r.p.m. would be as fast as it would be safe to run a well designed split wheel 12 feet in diameter, if made of cast iron.

As the centrifugal force varies as the square of the velocity, it is obvious that a reduction of the speed to 70 r.p.m. would greatly reduce the bursting tendency, and consequently the stress in the bolts. The stress in the latter should not exceed about 3,000 lbs. per sq. inch of net section, for in addition to the tensile stress there is a shearing stress on the bolts. If we reduce the speed of the wheel to 75 r.p.m., we shall have cut the speed in half, and the centrifugal force will have been divided by 4. The stress on the bolts would then be only about 2,800 pounds per square inch, which would be in accordance with modern practice.

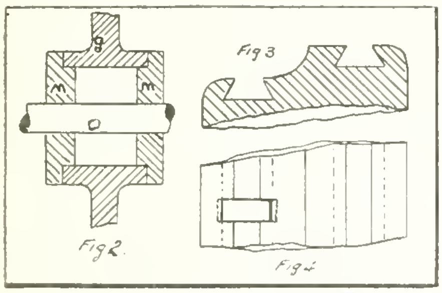
An objection may perhaps be raised by some readers that the above formula treats the whole weight of the wheel as being concentrated in the rim, and takes no account of the effect of the arms. This is, of course, true; but a complete and accurate treatment of the subject involves the use of higher mathematics, and the formula here given is the one generally employed. It gives a result quite accurate enough for practical purposes. When we consider the severe and entirely unknown stresses set up in the wheel by the cooling of the casting when it comes from the mould, it is obviously useless to figure out the centrifugal stress too closely. In wheels having a comparatively light rim, the bending stresses in the rim, due to the centrifugal force of the portions between two arms, may very possibly increase the calculated stress by 50 per cent.; hence it will be admitted that an approximation to the truth is all that can be looked for, or usefully employed.

TURBINE ROTOR WHEEL BLADING ATTACHMENT.

By H. Womersley.

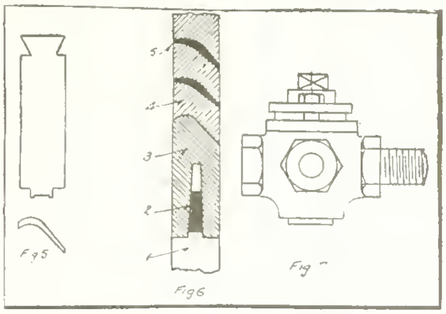
When blading a turbine casing and rotor, a great majority of the blades have to be put in by hand. The casting blades are all put in by hand, but we have found out a means whereby to blade the rotor wheels mechanically. When it comes to sliding thousands of blades and packing pieces around a 7-ft. dia. wheel, it gets monotonous and tiring. The accompanying sketch shows how to avoid this.

Fig. 1 shows the general arrangement. Brackets (H) (B) (C) support shaft (D), which in turn holds pulleys (E) and (F), also rotor wheel (G). An air cylinder (H) is fitted overhead to provide power for turning shaft (D). Bracket



ROTOR WHEEL BLADING

(I) is fitted with a butting lever (J) to butt blades into position when wheel revolves. Levers (K) are provided to ease the butting lever, being manipulated from the floor with foot. Brackets (A) (B) (C) and (I) are fitted to bed plate. Fig. 2 shows how the wheel is held in position. The bore of the wheel is approximately 12 in. dia., therefore two pads (M) are used to make up the size from the shaft (D). Pads (M) are held



ROTOR WHEEL BLADING.

to wheel (G) with size ¾ in. bolts, and a key holds them to shaft (D). Fig. 3 shows a section of wheel rim.

Fig. 4 is an outside elevation of rim, and shows how the groove must be cut out to receive blades. Fig. 5 is a view of a blade. Fig. 6 shows method of blading, 1 being groove in wheel, 2 being steel wedge to lock stop, 3 the stop against which the first packing piece is butted, 4 the packing piece, and 5 the blades. Fig. 7 is a three-way cock for regulating air in cylinder; it is fixed to bracket (I). With a little practice on this rig-up, the operator can regulate the face of the wheel quite accurately.

MACHINING GAS ENGINE CAMS.

By R. Bell.

In a shop requiring a limited number of gas engine cams which had to be made to exact dimensions, the following

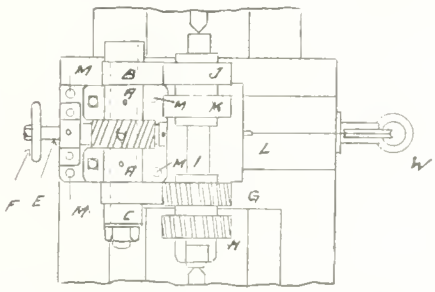


FIG. 1. MACHINING GAS ENGINE CAMS.

method was devised to machine the profile. It was decided to mill them, and a fixture as shown in Fig. 1 was made to carry out this operation in the lathe. It was arranged to fix it to the top of the cross-slide, the holes (M) being provided for that purpose. The tool rest was removed. Spindle (A) carried at one end a hardened master cam (B), secured to the spindle, while the cam to be machined was put on the other end (C). Previous to this operation the cams had all the other machine work completed on them, the key-way being also cut. A feather in the end (C) at spindle (A) fitted into the cams, by which means the rough cam was located quickly in proper relation to the master cam. On the centre of spindle (A) was secured a worm wheel (D) which meshed into a worm on spindle (E), on the end of which was a hand

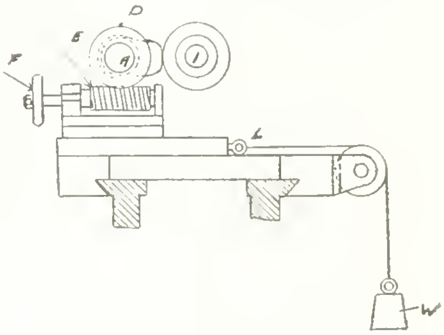
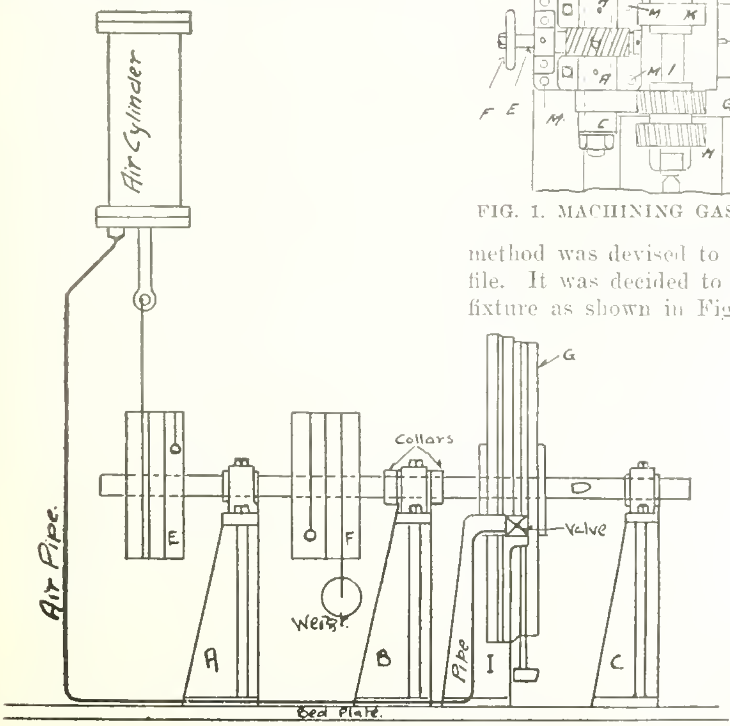


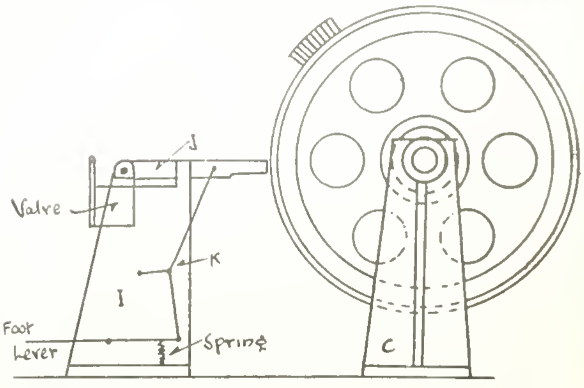
FIG. 2. MACHINING GAS ENGINE CAMS.

wheel (F). By this means spindle (A) could be rotated.

Two milling cutters (G and H) were carried on a mandrel (I) between the lathe centres. These cutters were opposite the cam to be machined. On mandrel (I) were also two discs (J) (K), which were opposite the master cam. These discs were free to rotate on the mandrel. Disc (J) was 1-16 in. bigger in diameter than the milling cutters, while (K) was the same diameter. The screw was removed from the cross-slide, and to a hook (L) a weight was attached as shown in Fig. 2. The object was to have the cross slide free to follow the profile of the master cam. The weight (W) was heavy enough to hold the master cam in contact with the disc while the cutter was working.

The saddle was set so that the master





TURBINE ROTOR BLADING ATTACHMENT.

cam was in contact with disc (J) and the cutter start. Spindle (A) was turned by means of the hand wheel F. The master cam as it revolved moved the cross-slide back and forward, the cutter thus machining the rough cam to the same profile as the master cam. After this cut was completed, the cam had still 7-32 in. more material all round than the master cam, due to disc (J) being 1-16 in. greater in diameter than the cutter. The saddle was now set with the master cam opposite disc (K), and the operation repeated. This removed the remaining material, finishing the cam to size. It was found that this method left a better finish than taking all the material at one cut.

PROLONGING THE LIFE OF STEEL RULES.

By D. A. Hampson.

A GREAT many shop men carry steel rules ("scales") in the pockets of their overclothes along with centre punches, screws, and assorted odds and ends. Borrow one of these rules and you will find its edges and corners all rounded over and tapered back, so that the graduations are barely visible at the places where they are most needed. When the owner can stand it no longer he goes and buys a new rule.

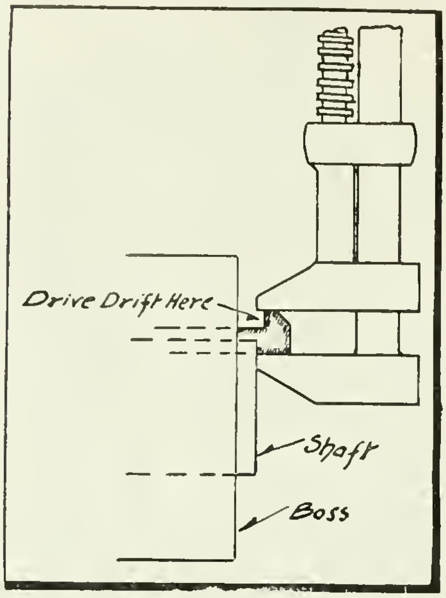
Probably because the manufacture of steel rules is a specialty apart from the general run of shop work, few machinists ever think of doing anything for an old rule. Yet, if there is any sort of a surface grinder in the shop, the round edges can be quickly brought back to their original state of "squareness," as it might be termed. Ten minutes' work on the grinder will put a four or a six-inch rule into such shape that a man can be proud to use it rather than be ashamed.

Steel rules are remarkably cheap, and it is not always advisable or profitable to try to renew their life—particularly if the whole surface is worn so that the marks are dim—but many times it is worth while doing, "and it will help a fellow over until Saturday night, when he can get to a store to buy a new one."

HOW TO PULL A TIGHT KEY.

By C. H. Lloyd.

I NOTICED in the Feb. 5 issue of Canadian Machinery a kink sent in by N. G. Near, showing a method of pulling a tight key. This reminded me of a similar method which I have often used with success. Place a common monkey wrench on the head of the key, as shown in the sketch. Between the head of the key and the wrench drive a drift made of an old file tang or some other piece of steel, and steady the wrench with the hand, so that the key will not bend. The wrench holds the drift in place and prevents it flying out. It will be seen that



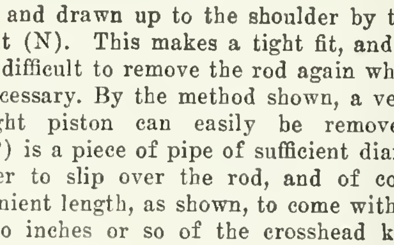
REMOVING A TIGHT KEY.

the drift must not be thicker than the height of the head on the key. With this device it is possible to draw very stubborn keys without damage.

REMOVING LOCOMOTIVE PISTON RODS FROM HEADS.

By R. Bell.

THE sketch is descriptive of a good method of removing piston rods from heads. These, when put on, are generally fitted up on the taper to within an ⅛ in. of the shoulder (A). The piston is then heated and the rod put



REMOVING LOCO PISTON RODS FROM HEADS.

in and drawn up to the shoulder by the nut (N). This makes a tight fit, and it is difficult to remove the rod again when necessary. By the method shown, a very tight piston can easily be removed. (P) is a piece of pipe of sufficient diameter to slip over the rod, and of convenient length, as shown, to come within two inches or so of the crosshead key slot. The distance between the end of the pipe and the slot can be made up with washers (W) (W) of suitable thickness, which afford a better surface for the key (K) than would the edge of the pipe. Their use also allows for a little variation in the distance between the piston head and the key slot in different rods. The washers must overlap the inner edge of the key slot so that the key will have a little draw. (K) is a tapered steel key. The pipe and washers are put on, as shown, and the key driven in with a sledge hammer. This method is much quicker and easier than heating the head when a rod has to be removed.

REPLACING GAUGE GLASSES.

By R. BELL.

IN the January 29th issue of Canadian Machinery, one of your correspondents mentions a difficulty he has with gauge glasses bursting after being replaced following cleaning. In the first place, I might ask if it is not rather an unusual practice to remove glasses for cleaning? Blowing a glass through regularly generally keeps it clean. With regard to the glasses breaking, I think this might be explained as follows:

It would be impossible to put in a glass and screw up the packing nuts without setting up strains in the glass in certain directions. A new glass is flexible to a certain extent and allows for these strains. Now, is it not possible that after a period of service, a glass becomes less flexible, and on being replaced after cleaning we may set up a strain in it in a different direction than previously; under these conditions the glass will therefore be very liable to fracture. I have noticed on several occasions that glasses often burst after any interference with the mountings.

HINT TO LATHE MAKERS.

By J. Davis.

I DARESAY every machinist has at some time or other had a shaft or other work in the lathe that required to be marked off for key seats. If there is only one key seat to be marked off it is an easy matter to run a sharp-pointed tool along while the lathe is standing, and thus mark a line parallel with the centres. If two lines be required opposite to each other or at right angles, it is a different proposition, and necessitates quite a bit of monkeying around with a surface gauge or other apparatus. It seems to me that if makers of lathes would mark off the faceplates with about eight lines equally spaced running from circumference to centre it would be much appreciated, and would many times save setting up the job for no other purpose than to mark it off.

St. Thomas, Ont.—Tenders will be received until March 25 for a road oil sprinkler. M. Ferguson, city engineer.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

Doubtless some of the elementary work in the first few articles of this series may appear more or less superfluous, but it must be remembered that numerous simple rules and formulae appear from time to time in Technical Journals, which are discarded and dubbed impractical by many operators for the simple reason that the elementals are either unknown or have been forgotten. The purpose of this course will have been achieved if the above tendency is even in part combatted.

INVOLUTION and evolution were explained, and the procedure to be followed in the extraction of the square root of a number was detailed in the concluding section of the lesson in our March 5 issue. In the present instance, extraction of the cube root of a number, and ratio and proportion are the features dealt with.

Cube Root.

The cube root of a number is found in this manner: Suppose we wish to cast an iron sphere which will weigh 266 lbs., what must be the diameter?

Assuming a cubic inch of iron to weigh .26 of a lb.; then 266÷.26=volume in cubic inches of the sphere=1023.077 cu. in.

To find diameter, use the formula Volume=.5236 d³, or

$$d^3 = \frac{\text{Vol.}}{.5236} = \frac{1023.077}{.5236} = 1953.928.$$

Then $d = \sqrt[3]{1953.928}$.

Explanation.—Arrange the work in three columns, placing the number whose cube root is to be extracted in the third

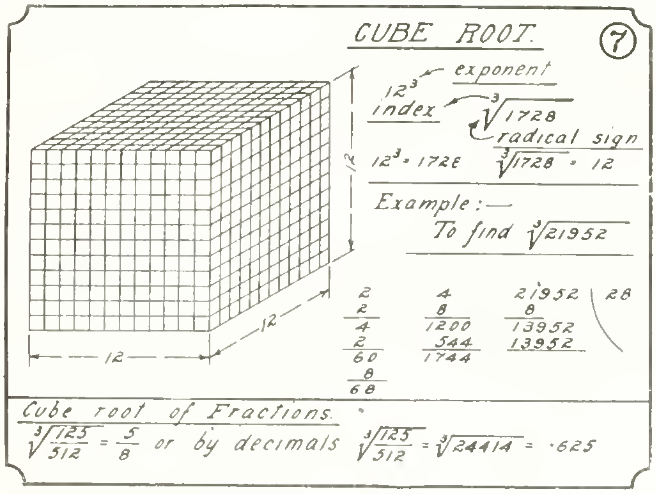
One	Two	Three
1	1	1953.928(12.68
1	2	1
2	300	953
1	32	664
30	332	289.928
2	68	253.176
32	40000	36752000
2	2196	35784832
34	42196	967168
2	2232	
360	4442800	
6	30304	
366	4473104	
6		
372		
6		
3780		
8		
3788		

column. From the decimal point, separate the number into periods of three figures each. Find a number whose cube is less than the first period. Write this figure as the first figure of the root, also at the head of the first column.

Multiply the number in the first column by the first figure of the root, and write the result in the second column. Multiply the number in the second column by the first figure of the root, subtract the product from the first period, and annex the second period to the remainder for a new dividend. Add the first figure of the root to the number one cipher to the second correction, and two ciphers to the last number in the second column to form a new trial divisor. Continue in like manner to the last period.

To extract the root of a fraction, extract the required root of the numerator and denominator separately; or change to a decimal, and extract the root of the decimal. (See Chart 7.)

Consistent study of this subject will prove of much benefit to those who have



ARITHMETIC CHART 7.

in the first column for the first correction; multiply the first correction by the first figure of the root, and add the product to the number in the second column. Add the first figure of the root to the first correction to form the second correction. Annex one cipher to the second correction, and two ciphers to the last number in the second column. This is the trial divisor.

Divide the dividend by the trial divisor, to find the second figure of the root; add this to the number in the first column, multiply the sum by the second figure of the root, and add the result to the trial divisor to form the complete divisor. Multiply the complete divisor by the second figure of the root, subtract the result from the dividend, third column, and annex next period to the remainder for a new dividend. Add the second figure of the root to the first column to form the first correction; multiply the first correction by second figure of the root, and add the product to the complete divisor. Add the second figure of the root to the first correction to form the second correction. Annex

been hitherto unfamiliar with its application.

Ratio and Proportion.

Ratio is the comparison between two numbers of the same kind or denomination, as, 4 is to 8, 120 revolutions is to 180 revolutions, 35 teeth is to 70 teeth; etc. (See Chart 8.) The expression of a ratio is shown in several ways: thus, 3÷2, 3:2 and $\frac{3}{2}$. That generally used is the second; 3:2, the above ratios being expressed, 4:8, 120 rev.: 180 rev., 35 teeth: 70 teeth, etc. A ratio may be raised to any power, or any root of it may be taken. (See Chart 9).

Proportion (or the rule of three) is one of the most useful sections of mathematics. It is an equality of ratios, indicated by the sign of equality (=). Thus the ratio of 8:6 is equal to the ratio of 24:18, or 8:6=24:18.

Each ratio of a proportion is called a couplet, and each number is called a term. The first and fourth terms are called the extremes, the second and third are known as the means. In any pro-

portion, the product of the means equal the product of the extremes. A direct proportion is one in which both couplets are direct ratios, while an inverse proportion is one which requires one of the couplets to be expressed as an inverse ratio. Such an expression must be changed to a direct proportion by inverting one of the couplets before solution. The principle of all calculations in proportion is that three of the terms are always known: the fourth being required.

The circumference of two circles vary directly as their diameters, therefore, the circumference of a circle 5 inches in diameter being 15.708 inches: what is the diameter of a circle whose circumference is 23.5 inches?

Expressing the unknown quantity by x, we have

$$5 : x = 15.708 : 23.5.$$

$$\text{Then } x = \frac{5\times 23.5}{15.708} = 7.48 \text{ inches.}$$

Again, the output of a certain machine being 80 pieces a day: what would be the result if the driving pulley was changed from 15 inches dia. to 18 inches dia.?

$$15 : 18 = 80 : X,$$

$$\text{then } X = \frac{\overset{6}{18}\times \overset{16}{80}}{\underset{3}{15}} = \frac{6\times 16}{1} = 96 \text{ pieces.}$$

In a belt drive, the speed of a certain spindle was 514 revs. per minute. The driving pulleys were 20 in. and 18 in., and the driven pulleys 14 in. and 10 in. diameters. The main shaft has a speed of 200 rev. per minute. Wishing a spindle speed of about 600 rev. per minute, and the only pulleys available being of 20 in. and 12 in. diameter; which one should be used and where, to give the desired result?

The speed of a driven shaft varies directly as the diameter of the driving pulley, or inversely as the diameter of the driven pulley, therefore, the larger the driving pulley, the greater the speed, and vice versa.

Replacing the 18 in. driving pulley with that of 20 in., we get

$$514 : X = 18 : 20$$

$$\text{or } X = \frac{514\times \overset{10}{20}}{\underset{9}{18}} = \frac{5140}{9} = 571 \text{ revolutions.}$$

Using the 12 in. diameter in place of the 14 in. driven pulley, we have

$$514 : X = 12 : 14 \text{ or } X = \frac{\overset{257}{514}\times \overset{7}{14}}{\underset{3}{\underset{6}{12}}} = \frac{257\times 7}{3}$$

$$= \frac{1799}{3} = 599 \text{ revolutions.}$$

Then by using the 12 in. diameter as a driven pulley in place of the 14 in., we get the required result.

The areas of regular plane surfaces vary as the square of their sides or diameters. (See Chart 9).

A piece of steel 1 in. round, and 4 feet long weighs 10½ lbs.; what is the weight of a bar of 2 in. round and 4 feet long?

$$1^2 : 2^2 = 10\tfrac{1}{2} : X \text{ or } X = \frac{2^2\times 10\tfrac{1}{2}}{1^2} = \frac{2\times 2\times 10.5}{1\times 1} = 42 \text{ lbs.}$$

To find the mean proportion between two numbers. (See Chart 9).

The lesser is to the mean as the mean is to the greater of the two numbers.

What is the mean proportion between 9 and 16.

$$9 : X = X : 16 \text{ or } X\times X = X^2 = 9\times 16 = 144$$

$$\text{then } X = \sqrt{144} = 12,$$

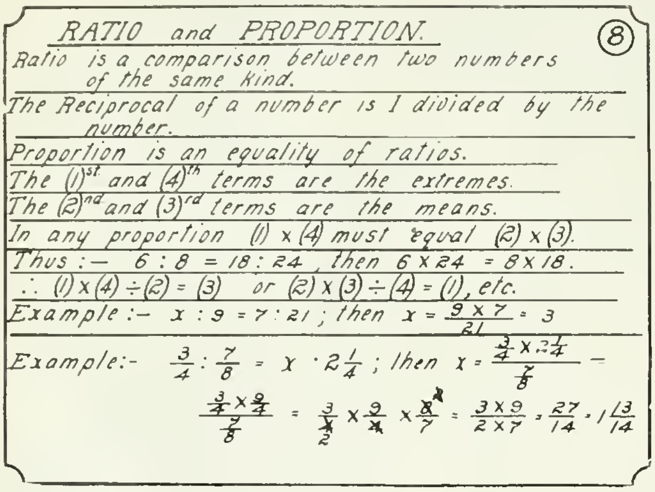
$$\text{therefore } 9 : 12 = 12 : 16.$$

Further remarks may be necessary on the foregoing in the solution of forthcoming shop problems.

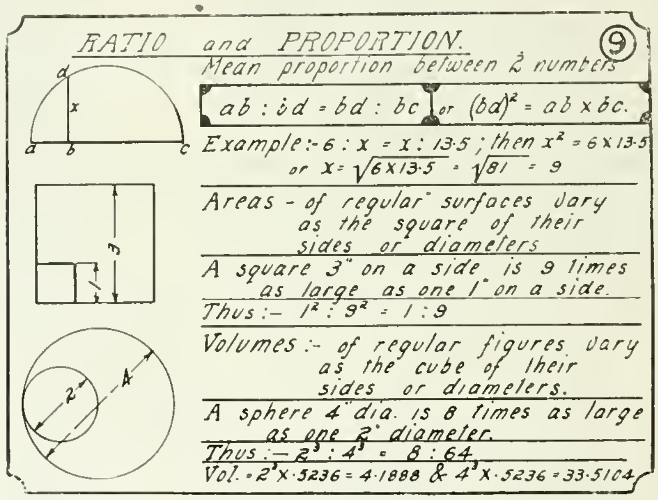
QUEBEC HARBOR EXPENDITURE.

An expenditure of $2,273,559 during 1914 is recommended by the Harbor Commissioners of Quebec in their annual statement recently tabled in the House of Commons, by Hon. J. D. Hazen. The total is made up as follows: Dredging a trench for the proposed quay wall and the channel approach, $400,000; extension to the Louise embankment, together with necessary filling, $952,029; railway terminals for extending the delivery yard accommodation, trackage for the new grain elevator, railway tracks to serve the bulkhead shed in connection with the car ferry terminals, $50,000; purchase of Indian Cove property, required as service ground in conection with works under way, $108,964; for the purchase of four locomotives required by the commission for operating their railway lines, $50,000; to provide grain-loading galleries in the new grain elevator, $500,000 (these will be of fire proof construction, capable of delivering grain to ocean vessels at the rate of 40,000 bushels an hour); to provide ten dock scows for use in the various works, $75,000; for completing the retaining wall at Lampson's Cove for a length of 1,400 feet, $137,565.

Disastrous Results Anticipated.—H. H. Biggert, manager of the International Harvester Co., Hamilton, Ont., says the proposed reduction of ten per cent. on agricultural implements would be almost fatal to the Canadian industry. He said the manufacturers would fight for an equivalent reduction on all raw material.



ARITHMETIC CHART 8.



ARITHMETIC CHART 9.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

SAYS PROFIT-SHARING IS WRONG

BRITISH employers and workers have not yet got over the shock created by the announcement of the new scale of wages to be paid by Henry Ford to his workmen. It has made the big London firms ask themselves: "What is the secret in a large business of maintaining friendly relations between employer and employed?"

The Foremen Feature.

According to James Pascal, a big employer in the British capital, the answer is quite simple. It lies in the choice of foremen. A good employer, if he be wise and just, will select his foremen with an eye to their moral fitness for the command of men. Much of the trouble in the labor world, although you may not read about it in the newspapers, can be traced back to the bullying manner, or the distinct tyranny of individual foremen; far more injustice is perpetrated by these non-commissioned officers of commerce than the world ever hears about. A bad-tempered foreman creates an evil spirit.

Employer's Personal Responsibility.

"My foremen are my representatives. They distribute the feeling of kindness which I wish to exist, and in cases of dispute, every man and woman, every boy and girl, knows that there is an appeal from the foremen's ruling to the chief; and the foremen know this too. The foremen are not made the final arbiters of a dispute; even the most trusted and honored of our foremen know that in the last resort they must appear with the man in trouble before me or my partners. That is to say, while we exercise the greatest possible care in choosing our foremen, selecting only such men as will encourage the good worker and help to preserve a kindly and a human feeling in the factory, we still feel that the personal responsibility is ours, and ours alone, in seeing that justice is done, justice tempered with mercy, to the least of our employees."

Pay Best Wages.

Pascal does not believe in profit-sharing. His plan is to pay the best wages justified by the business. He has good reasons for thinking that "profit-sharing" is a fine phrase, in too many instances, for obscuring the scandal of unjust wages. On the other hand, there is a social side to the Pascal business in the hands of an able and sympathetic manager. Meals are provided at a fraction over cost price, rooms are set apart for music, billiards and reading, and a home of rest is kept going at the seaside.

Money-Grubbing the Cause.

"My view as to labor troubles," he said, "is simply this: Money-grubbing on the part of employers is the root-cause. Take, for instance, the case of a bad foreman, who spreads an inhuman feeling throughout a factory. Who is really responsible? Is it not the employer himself, who selects such a man in the hope that he will screw the uttermost out of his workpeople? Directly an employer of labor loses his sense of moral responsibility, trouble begins, and not all the dodges and shifts of intervention can prevent the spread of that trouble.

Must Come to Senses.

"There is only one remedy—the employer must come to his senses and act as a moral being. I am perfectly sure that the worship of money is at the bottom of all social unrest. Men will not distinguish between wealth and riches. They throw away the elementary characteristics of a human being, they may become monsters in their hunger for gain. Now, such an attitude on the part of a human being toward riches is irrational. To a philosopher it must seem madness; to a Christian blasphemy, but to every business man it ought to be patently absurd.

"For what is money? Money is not happiness, but the means of happiness. I regard a dollar as a machine. Too many employers regard their workpeople as machines."

CANADIAN 1913, MINERAL OUTPUT.

A PRELIMINARY report on the mineral production of Canada during the calendar year 1913 has been issued by the Department of Mines of Canada. It shows a value for the year of $144,031,000. Although estimates have been made in some cases where complete returns were not available, it is probable that the final record will be a revision upward. The total value of the production in 1912 was $135,048,000 compared with which the 1913 output shows an increase of $8,982,751 or 6.65 per cent. In view of the large increase over all previous years made in mineral production in 1912, and the general trade depression and industrial restriction experienced during the latter part of 1913, the industry would appear to have made in the aggregate very satisfactory progress. The average production per capita in 1913 was $18.75 as against $18.27 in 1912 and $14.93 in 1910.

Production Since 1886.

The record of annual mineral production in Canada since 1886 shows the rapid growth of the industry, for not only has the total output increased from a little over $10,000,000 in 1886 to its present output, but the average production per capita has increased from $2.23 per capita to $18.57, or eight times the rate shown by the first record.

Year	Production	Per capita.
1886	$10,221,255	$2.23
1887	10,321,331	2.23
1888	12,518,894	2.67
1889	14,013,113	2.96
1890	16,763,353	3.50
1891	18,976,616	3.92
1892	16,623,415	3.39
1893	20,035,082	4.04
1894	19,931,158	3.98
1895	20,505,917	4.05
1896	22,474,256	4.38
1897	28,485,023	5.49
1898	38,412,431	7.32
1899	49,234,005	9.27
1900	64,420,877	12.04
1901	65,797,911	12.16
1902	63,231,836	11.36
1903	61,740,513	10.83
1904	60,082,771	10.27
1905	69,078,999	11.49
1906	79,286,697	12.81
1907	86,865,202	13.75
1908	85,557,101	13.16
1909	91,831,441	13.70
1910	106,823,623	14.93
1911	103,220,994	14.42
1912	135,048,296	18.27
1913	144,031,047	18.57

The continuance during 1913 of the strike at the mines of the Canadian Collieries (Dunsmuir), Ltd., and its extension to the other collieries on Vancouver Island, seriously restricted the coal output from that district. The total value of the metals was also somewhat smaller than it might otherwise have been because of the slightly lower average prices obtained for copper and silver. A restricted demand was also reported during the latter part of the year for brick and other clay products and structural materials.

While these are some of the influences

that have tended to curtail the mineral output during the year, there have on the other hand been important increases in the production of gold, nickel, lead, amongst the metals, in asbestos, natural gas and many of the other lesser valuable non-metal products and in cement, resulting in the net increases already shown.

Metals Production.

The production of the more important metals and minerals is shown in the following tabulated statement which the figures are given for 1912 and 1913 in comparative form:

	1912.	1913.
Copper	$ 12,718,548	$ 11,753,440
Gold	12,648,794	16,216,121
Pig iron	14,550,999	16,540,012
Lead	1,597,554	1,754,705
Nickel	13,452,463	14,903,032
Silver	19,440,165	18,984,012
Other metallic products ...	864,343	1,520,072
Total	$ 75,272,866	$ 81,671,404
Less pig iron credited to imported ores	14,100,113	15,543,583
Total	$ 61,172,753	$ 66,127,821

Non-Metals Production.

Asbestos and asbestic ...	3,137,279	2,849,925
Coal	36,019,044	36,250,311
Gypsum	1,324,620	1,477,589
Natural gas..	2,362,700	3,338,314
Petroleum ...	345,050	406,439
Salt	459,582	491,280
Cement	9,106,556	11,227,284
Clay products	10,575,869	9,673,067
Lime	1,844,849	1,605,812
Stone	4,726,171	5,199,204
Miscellaneous non-metallic	3,973,823	4,384,001
Total	$ 73,875,543	$ 77,903,226
Grand total	$136,048,296	$144,031,047

Of the production in 1913 a value of $66,127,821, or 45.9 per cent. is credited to the metals and $77,903,226, or 54.1 per cent. to the non-metallic products. The increase over the value for 1912 in metallic products was $4,955,068, or 8.1 per cent., and in non-metallic products, $4,027,683, or 5.45 per cent.

There was an increased production of each of the metals except copper and silver, the most important increase being in gold with 28 per cent. Pig iron increased 11.3 per cent. in tonnage, lead, 5.3 per cent. and nickel 10.8 per cent. The falling off in copper was only 1.1 per cent., in quantity, although 7.6 per cent. in total value, and for silver 0.6 per cent. only in number of ounces, and 2.3 per cent. in value, slightly lower average prices having been obtained for these metals.

Amongst non-metallic products increases are shown in all the important products except clays and lime. The largest increse was in natural gas, with 41 per cent. in value. The cement output was greater by 21 per cent. in quantity, asbestos 18 per cent., coal 4 per cent., gypsum 10.5 per cent., salt 6.04 per cent. In the case of petroleum there was a falling off of 6 per cent. in quantity, but on account of higher prices an increase of nearly 18 per cent. in total value. The decreases in clay products and lime were respectively 8.5 per cent. and 12.9 per cent.

Mineral Production by Provinces.

The mineral production by Provinces in 1912 and 1913, is given as follows:

	1912.	1913.
Nova Scotia..	$ 18,922,236	$ 19,305,545
New Brunswick	771,004	1,049,932
Quebec	11,656,998	13,303,649
Ontario	51,985,876	58,697,602
Manitoba	2,463,074	2,211,159
Saskatchewan.	1,165,642	899,233
Alberta	12,073,589	13,844,622
British Columbia	30,076,635	28,529,081
Yukon	5,933,242	6,190,224
Dominion ...	$135,048,296	$144,031,047

The Cement Industry.

On the cement industry the bulletin has the following:

The financial stringency during 1913 had an immediate effect in the restriction of building operations of all kinds and its results are shown in the statistics of production and consumption. In the case of cement, while a very substantial increase in production is shown, this has seemed chiefly to displace imported material, the increase in consumption being only 4 per cent. as against an increased production of 24 per cent. Canadian mills supplied over 97 per cent. of the consumption in 1913 as against 83 per cent. in 1912.

The industry has been marked by the extension of old and the completion of new plants, the latter west of the Great Lakes. The total capacity of completed plants at the end of the year being about 50,000 barrels per day, as compared with 36,500 barrels at the end of 1912. New plants were placed in operation at Winnipeg, Marlboro, west of Edmonton; Princeton, B.C., and at Tod Inlet, Vancouver Island, B.C. The plants of the Imperial Portland Cement Company at Owen Sound and of the Crown Portland Cement Co. were not operated during the year.

The quantity of Portland cement, including slag cement and natural Portland made in 1913 was 8,888,983 barrels, an increase of 1,739,979 barrels or 24 per cent. over 1912. The quantity of Canadian cement sold or used was 8,658,922 barrels, valued at $11,227,284, or $1.29 2-3 per barrel, an increase of 1,526,190 barrels or 23 per cent. and $2,120,728 or 23 per cent. in total value. The total imports of cement were 889,324 cwt., equivalent to 254,092 barrels of 350 pounds each and valued at $409,303, or an average of $1.61 per barrel, as compared with imports of 1,434,413 barrels valued at $1,969,529, or an average of $1.37 in 1912. The total consumption of Portland cement, therefore, neglecting a small export, was 8,913,014 barrels, as compared with a consumption of 8,567,145 barrels in 1912, an increase of 345,869 barrels, or only 4 per cent.

CANADA FOUNDRIES & FORGINGS, LTD.

THE statement of the Canada Foundries & Forgings Co. shows that not only were profits better than in 1912, but substantial amounts were also allowed for repairs, renewals and depreciation. Following is the profits and loss statement, which shows what the profits were, and how they were disposed of:

Profit and Loss.

To depreciation	$ 21,700.00
To interest	4,049.50
To general expense	3,444.16
To written off bond discount..........	507.00
To written off organization expense	2,405.71
To preferred dividends	67,200.00
To bond interest	4,053.11
To balance	35,220.20
	$138,579.68
By balance Dec. 31st, 1912	$ 25,680.33
By net earnings for 12 months ending Dec. 31st, 1913	112,899.35
	$138,579.68

Big Additions to Plant.

Additions to buildings, machinery and equipment chargeable to Capital Account made during the year amounted to $85,308, the principal items in which are the new steel forge shop at the Canada Forge Co., to replace the wooden structure destroyed by fire, electric cranes, sidings, etc.; and at Canadian Billings & Spencer, a boiler house and boilers, steam drop hammer and accessories. To provide in part for this expenditure, bonds have been issued and disposed of during the year to the amount of $50,700.

In regard to the outlook for the present year, the President, Mr. John M. Gill, says the following, in his annual report:

Outlook Good for 1914.

"The trade depression that set in about the middle of last year is still in evidence, but it is hoped that the arrival of spring will see a return to normal conditions. While our trade in Eastern Canada and for export has been and is

perfectly satisfactory, the returns from the Northwest and the Pacific Coast have been mush below the record of former years. Should favorable conditions be restored west of the Great Lakes, there is every reason to suppose that the year 1914 will be one of average prosperity to our company."

The following is the Board of Directors for 1914: Messrs. John M. Gill, President; J. H. Housser, Vice-President; John H. A. Briggs, Sec.-Treas.; Robert Bowie, Fred. C. Billings, W. H. Comstock, John T. Dillon, William M. Weir, Thomas J. Dillon, J. Gill Gardner, Hon. Geo. P. Graham.

MONTREAL HARBOR 1914 EXPENDITURES.

THE proposed expenditure on the harbor of Montreal during the coming year will be four and a half million dollars, according to the harbor improvements plans, submitted to the Minister of Marine, by W. G. Ross, president of the Harbor Commission of Montreal, and tabled in the House of Commons. It is stated that as the commission has not yet decided on the extent of its proposed railway operations, it has been decided that it will not be necessary to amend the acts in that respect during the coming session. The statement presents in detail the expenditure of the $1,000,000 already granted byParliament, and outlines the following as the programme for 1914:

Continuation of work on elevator No. 2, $808,678; harbor railway system, $282,674; railway equipment, $300,000; Victoria pier and market basin, $293,000; permanent wharf transit sheds, $477,990; warehouse, $200,000; shore wharves, sections 24 to 30, $164,789; amelioration of entrance to Lachine Canal, $50,000; property to be acquired for harbor purposes, Lachine Canal and vicinity, with improvements, $100,000; dredging and filling, $284,738; paving and wharf railways, $150,000; improvement to eastern section below St. Mary's current, floating dock site, $165,000; general improvements and plant, $200,000; permanent sheds, Tarte pier, and equipment, $8,474; Point aux Trembles industrial wharf, $130,0002; wharves and facilities south of Lachine canal, $100,000; industrial wharves, $100,000; St. Lamhert-Longueuil road and sewer, $100,000; over-flow dam and bridge for giving connection between Montreal's congested district and the South Shore and access to St. Helen's Island, $50,000; fire-proof office building, $100,000; retiring debentures, $200,000; real estate, $116,605; traffic plant, $192; Aylwin street subway, $50,000; unforseen items, $47,660.

The unexpected balance from previous votes of Parliament amounted to $2,743,571, on January of this year. The proposed expenditure during 1914, 1915, 1916 and 1917, will total $15,000,000, and Hon. J. D. Hazen has given notice of the necessary resolution for providing for advances to this amount.

Trade Gossip

The Jenckes Machine Co., Sherbrooke, Que., manufacturers of boilers, pumps, rock crushing and general machinery, etc., have opened a sales office at 309-311 Confederation Life Building, Toronto, with Mr. P. F. Doyle in charge.

Brompton Pulp & Paper.—The Brompton Pulp & Paper Co. have commenced work on a new iron bridge across the St. Francis River, about six hundred feet below their mills. They also intend building a new paper mill, 476 feet long, extending from the present mill to close to the new bridge. There are about one hundred men employed in building the new bridge, which is to be for the firm's private use only.

The World's Coal Production.—Information relating to the production of coal in the British Empire and foreign counthe general report compiled by the Chief Inspector of Mines, was recently published. The production of all countries for that year made a total of 1,187,000,000 metric tons, the value of which was estimated at nearly $2,175,000,000. Compared with 1901, the quantity and value showed an increase of 23,000,000 tons and $75,000,000. The three principal producing countries were the United States, Great Britain, and Germany, in order of output, the respective figures being 450,169,000 tons, a decrease of 4,876,000 tons; 276,255,000 tons, an increase of 7,579,000 tons; and 234,521,000 tons, an increase of 12,446,000 tons.

Canada Iron Corporation.—" It was a gigantic undertaking for a young country like Canada. I am afraid that while the management may have been competent enough for an ordinary size business, it was entirely inadequate for an undertaking of this size." This was the opinion of Lawyer Payne, who met on March 6 the bondholders of the Canada Iron Corporation, now in liquidation, and told them the result of his negotiations in Montreal. The undertaking was floated in 1908, and owned foundries, blast furnaces, and mines in various parts of Quebec and Ontario, the idea being that the mines should supply the furnaces and so forth. However, the mines were a considerable distance from the furnaces, and the transportation of ore proved a very costly affair. Payne advised the bondholders to pin their hopes to the foundries, which had made a profit of over $106,000 in the last four months. Some new capital was absolutely necessary, as $600,000 worth of material was now in the grip of the banks for money lent. He thought a million dollars at the outside should be raised. The meeting appointed a committee of inspection.

U.K. Pig Iron Production.—The following preliminary figures have been issued by the British Iron Trade Association, showing the pig iron production of the United Kingdom for 1913, as compared with the four preceding years:—

Year.	Tons.
1913	10,479,171
1912	8,889,124
1911	9,718,638
1910	10,217,922
1909	9,664,287

Trade With United States.—According to figures just made public by the Trade and Commerce Department, covering Canadian trade for the past calendar year, the United States still provides the chief source of increase in Canada's annual trade growth. During 1913, imports from the United States increased by $39,026,515, while exports to the United States increased by $23,261,296. This makes a total trade increase with the United States during the year of $62,281,811. As compared with this, imports from Great Britain increased by $6,477,256, while exports to Great Britain increased by $47,811,856, or a total trade increase with the mother country of $54,289,112. The total trade with the United States during the year was $634,653,973, consisting of imports to the value of $441,302,354 and exports to the value of $193,351,619. The total trade with Great Britain was $364,326,938, consisting of imports to the value of $139,811,893 and exports to the value of $224,515,045. The aggregate trade of Canada for the year was $1,147,648,243, as compared with $1,023,641,142 for 1912.

Reduced Coal Output.—The Intercolonial Co. output for last year was the smallest since 1889, and 37,267 tons smaller than that of 1912. The output has been falling off for years as a result of increased cost of production; as a consequence the company has been losing money. The company was recently reorganized. It held its annual meeting in Montreal recently, but, pursuing the policy of many years, no figures were made public beyond the output. Under the reorganization and management of Mr. Chas. Fergie, better things are looked for. The output of coal and coke for the year 1913 amounted to about 200,000 tons compared with 235,857 tons in 1912. The following were elected directors for the coming year:—Messrs. D. Forbes Angus, K. W. Blackwell, Chas. Fergie, James Floyd, R. MacD. Patterson, E. Goff-Penny, and R. W. Reford.

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

NEW LINE ROLLER BEARINGS.

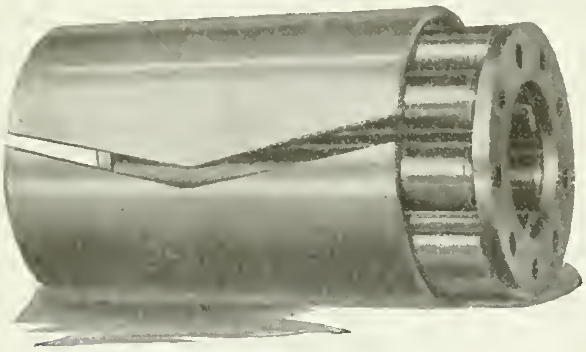
A NEW and complete line of roller bearings, incorporating several new features, has recently been placed on the market for service in many forms of journal roller bearings. Every type of this line appears to bear the stamp of a careful analysis of the many conditions to be faced. A study of the accompanying illustration reveals several interesting points, chief among which seem to be ease of application, absence of roller friction, and a design that points to long bearing life.

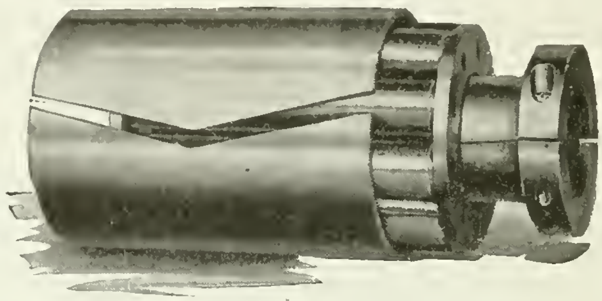
These bearings embody the basic principles of the successful types of line-shaft bearings that the Royersford Foundry and Machine Co., Philadelphia, Pa., have been marketing for a number of years. A saving of at least twenty-five per cent. of the friction load is, we understand, guaranteed by the manufacturer, and it is reported that in many instances much higher savings have been made; which points to augmented capacity or a cheaper rate of production per machine that has been equipped. Instances are cited where a power plant which has been overloaded in driving machinery equipped with babbited bearings has run below capacity, after the substitution of these types of roller bearings.

The line consists of five distinct types, four of which are for use in machinery, and one in heavy wagon hubs. The first, known commercially as the "Sells Special," has a shaft-protecting feature in a split sleeve which is clamped over the shaft by two split collars. Ease of application, assurance of fit, and low-cost protection given the shaft, are advanced as prominent advantages. One of the best power-saving points in these bearings seems to be the suspension of the rollers in a permanent, revolving roller structure that keeps them constantly parallel to the shaft, and out of contact with each other; the principle being, that under such conditions, the rollers do not jamb, or become tapered; aside from the fact that their separation is said to add much to the total reduction of friction.

The entire structure is enclosed within a high-carbon steel single-piece, or "Unit Lining," which takes the action of the rollers and prevents wear of the housing. The "V" cut shown in the illustrations is to provide a diagonal joint that allows the rollers to pass over it smoothly. Another type, intended for work similar to the "Sells Special" is known as the "Sells" Commercial Type. It is actually a duplicate of the former, minus the split sleeve and collars. This bearing is said to be especially suited for journals of mine, industrial, or other light-car axles.

Two other types, designed for high-grade machinery involving heavy loads or high speeds, are the "Sells" High Duty and "Sells" Journal Bearings. They do not differ in principle, but vary somewhat in the design of the roller structures, largely because the shorter length of the former requires rollers of larger diameter to give the same capacity as the latter, with its longer rollers. Where space is not a factor, they are said to perform equally well in a given service, but where the available bearing length is limited, the high duty are recommended. They are generally used in connection with ground sleeves and casings, and for protecting the shaft and housing, when these are not specially selected for direct contact with the rollers.


TYPE OF NEW LINE ROLLER BEARINGS.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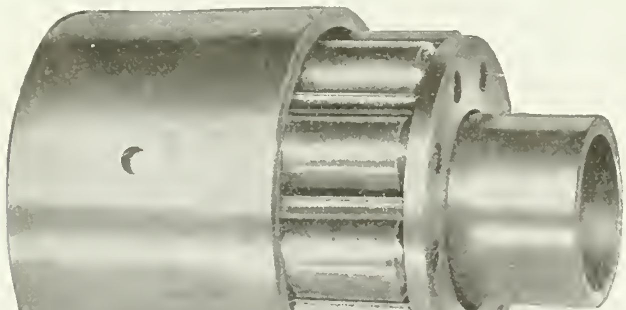
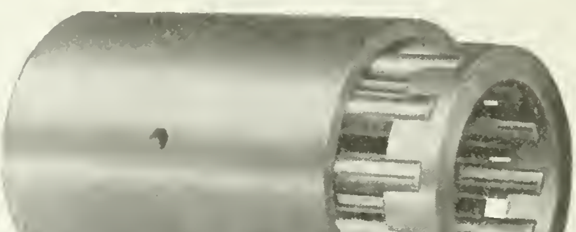

TYPE OF NEW LINE ROLLER BEARINGS.


TYPE OF NEW LINE ROLLER BEARINGS.

THE SIEVERKROPP ENGINE.

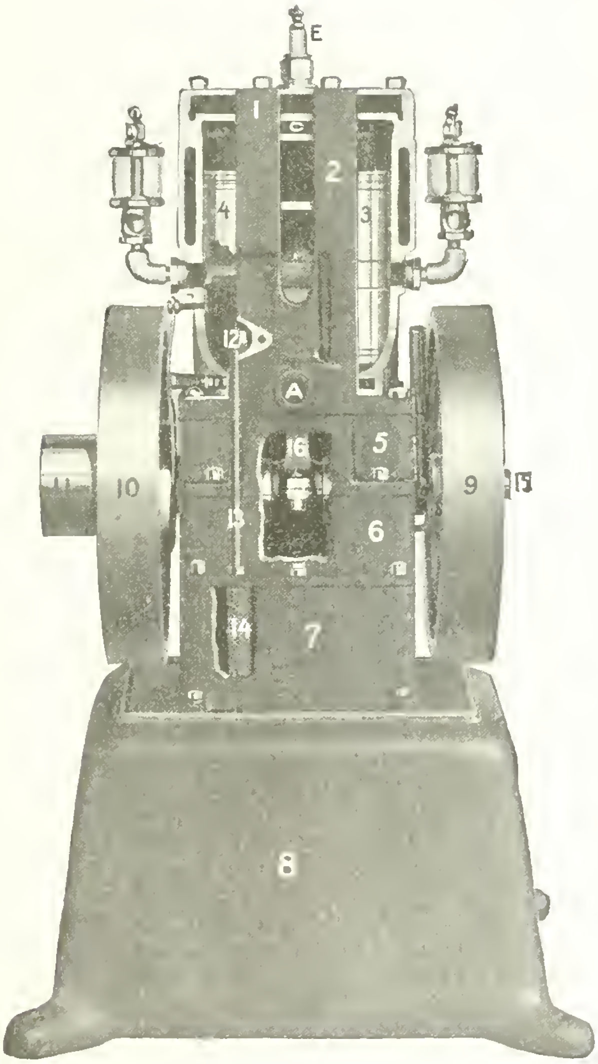
THE gasoline engine here illustrated has many features of interest to users of small power units for operating cream separators, small air compressors, feed grinders, etc. It is an entirely new type of two-cycle engine.

Referring to the illustration, it will be noticed that there are two pistons (3 and 4), acting on one connecting rod (16). The tops of the two cylinders are in communication with each other by means of the passage (C). As the pistons move upwards from the position shown in the cut, they create a partial vacuum in the airtight space below. When the intake port (12) is uncovered, air rushes in, creating a suction in the fuel pipe (13). As the gasoline arrives at the end of the suction pipe in the neck of the mixer, it is immediately atomized by the passing air and becomes thoroughly mixed with it.

The two cylinders are entirely cut off from the crank case, but are connected at the bottom by a channel or passage (A). The mixture thus fills the space under both pistons and also the insides of them. It does not, however, fill the crank case. As the pistons start on the downward stroke, the mixture intake port (12) is covered by the piston (4), which traps and slightly compresses the mixture until the piston (3) uncovers the intake port in the right-hand cylinder, when the mixture at once rushes in and fills the upper ends of both cylinders.

The inrush of the new mixture into the right-hand cylinder drives before it all of the remaining burnt gases through the passage (C) into the left-hand cylinder and on out through the exhaust port, which opens just before the intake port. Immediately the pistons start on the upstroke, the intake and exhaust ports are covered, and the fresh mixture is trapped in the top of the cylinders and compressed into a very small space in the cap. Just as the pistons reach the highest point, the compressed charge is fired by the spark plug (E), and the explosion that follows drives the pistons downwards, completing the cycle.

Before the pistons reach the lowest point of their stroke, the exhaust port opens, allowing the burnt gases to escape through the muffler. The intake again opens and the new charge of mixture which has been brought in on the previous up-stroke and partially compressed under the pistons, rushes into the upper parts of the cylinders, and the same action as previously described takes place.



The Sieverkropp Engine.

It will be seen that, unlike other two-cycle engines, the charge is not compressed in the crank case, where it is impossible to avoid leakage at the bearings; but is compressed entirely in the airtight chambers below the pistons. The builders claim a very low fuel consumption for this engine, which has been put on the market to fill the needs of farmers, small machine shops, motor garages, dairies, etc. It is said to be so simple that a woman or child can operate it. It is at present being built in small sizes only—½ h.p., 1 h.p., and 1½ h.p.; but the makers are now getting out designs and patterns for higher powers. They are also working on an engine of this type for motor boats.

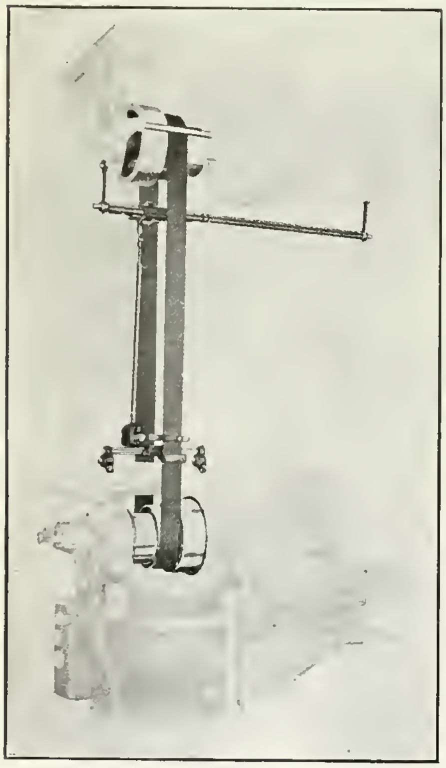
The Foss & Hill Machinery Co., Montreal, are sole Canadian distributors for the Sieverkropp engine.

LEBLOND BELT SHIFTER.

THE "LeBlond" belt shifter device consists of two relatively fixed sections of rack—one mounted on the headstock, and the other on the countershaft. A belt-shifting bracket is mounted on each of these racks and operated by means of a pinion with two teeth, which engages the rack and moves the two brackets in the same direction, one in advance of the other. The rack teeth are spaced one-half the width of the cone step, so that one complete revolution of the pinion moves the shifter bracket the full width of the cone step. A common crank, conveniently located, operates both pinions through a pair of mitre gears and a telescopic shaft, adjustable within certain limits for the height of the ceiling. One shifter always acts one-half revolution of the crank ahead of the other. The first half revolution moves the belt from a large to a smaller pulley on one of the shafts, the next half revolution moves the belt on to a larger pulley on the other shaft. When running, the crank always assumes the same position, convenient to grasp, the belt being locked against further movement except by turning the crank. A stop is provided in both directions to prevent the belt being thrown entirely off the cone. The belt is much longer lived, as the edges cannot curl up against the step of the cone. Wider belts can be used for the above reason, even to the full width of the step. This means greater driving power.

The speed changes are accomplished without effort on the part of the operator. A single revolution of the crank makes the speed changes as rapidly as the gear shift of an automobile transmission. The device converts any cone-driven machine tool into a quick-speed change mechanism, and places the cone-driven machine on the same plane of operating efficiency with the all-geared construction at a much lower initial investment and upkeep cost, while the operator is insured against any possibility of injury in shifting the belt. A simple turn of a crank conveniently placed changes the speed without stopping the cut or touching the belt. It being easy to shift the belt, the operator will change the speed to suit the work being done, instead of running both roughing and finishing cuts and different diameters at the same speed, as is often done. When facing with the cross-feed, the speed can be increased as the cut approaches the centre, keeping the proper cutting speed at all times.

This belt shifter is a product of the

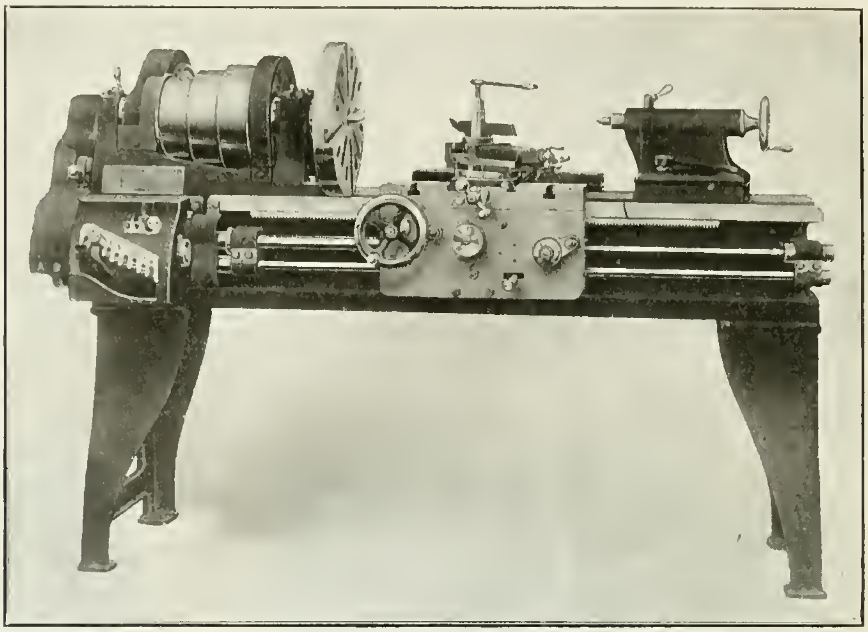


LE BLOND PATENT BELT SHIFTER.

R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, and can be adapted to any make of lathe, miller or drill.

16-INCH QUICK-CHANGE GEAR LATHE.

THE 16-inch quick-change gear lathe with three-step cone and double-back gears, here illustrated, is a product of the Von Wyck Machine Tool Co., Cincinnati, Ohio, who make engine lathes an exclusive specialty. Heavy construction, high finish and accurate fitting are leading features, all parts being made to standard jigs and gauges, and interchangeable.



16-INCH QUICK CHANGE GEAR LATHE.

The quick-change gear box is made as a single unit and is reckoned fool-proof. It contains 14 gears, all of steel, cut from the solid bar, and has but two operating levers, by which all changes are made without duplication. It is arranged with a large quadrant, which allows any odd pitch or metric threads to be cut. The headstock is massive, and has long bearing on bed. The spindle is of high carbon hammered crucible steel, accurately ground and running in large phosphor bronze boxes. The cone pulley is turned and ground to run absolutely true.

The carriage is heavy, well-ribbed, and has four bearings on bed. It is drilled in rear for taper attachment, which can be mounted at any time. A chasing dial permits threads to be chased without stopping lathe or reversing lead-screw, and allows two forward speeds on countershaft. The apron is of double plate type, with all gears and pinions of steel, and cut from the solid with special cutters. A non-interfering device is provided, making it impossible to simultaneously engage feeding and screw-cutting mechanism. The compound rest is large, and is graduated for setting, friction pulleys are ground to run perfectly true.

These lathes, owing to their large cone while the countershaft is equipped with two friction clutch pulleys of the latest design. The pulleys are fitted with self-oiling bushings, and the hanger boxes are ring oiling. The cone pulley and pulleys and wide bearings, are capable of taking extremely heavy cuts at coarse feed, and are guaranteed to reduce fifty-point carbon steel 1¾ inches at 1/16 feed. The swing-over bed is 16 in., and over-carriage 11¼ in. The lathe turns between centres on a 6-ft. bed, 36 inches, and will cut threads 3 to 46. The net weight is 1,700 pounds.

Baldwin Loco. Works Output.—The Baldwin Locomotive Works, after eighty-two years of continuous operation, has produced 40,000 locomotives. The first was completed in 1832, when the industry was in its infancy. The five-thousandth locomotive was built in 1850, eighteen years later, during which period two important types of good engines, the Mogul and Consolidation, were introduced and widely adopted. From 1889 to 1902, when locomotive No. 20,000 was built, compound locomotives came into extensive use, and trailing wheels, allowing increased boiler capacity without imposing excessive loads on the driving wheels, were introduced. The average annual production for the five years from 1902 to 1907 was approximately 2,000, and locomotive No. 30,000 was built in 1907. During this period occurred the introduction of the Mallet articulated compound locomotive, and the adoption of the Walschaerts valve motion. The last period is marked by the extensive use of superheaters, brick arches, and other devices, and the mechanical stoker is another accessory developed during the past few years.

ASSOCIATION AND PERSONAL

A Weekly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Machinery Circles

James Carruthers, President Canadian Steamship Lines, has gone to Bermuda.

J. B. Learmont, of Caverhill, Learmont & Co., Montreal, died on March 12, aged 70.

William McMaster, director of the Bank of Montreal, has arrived in London from Egypt.

J. W. Norcross, managing director of Canada Steamship Lines, leaves shortly on a tour of the lake terminals.

W. A. Black, president of the Ogilvie Milling Co., Montreal, is in Fort William. He is on a tour of inspection.

James Moore, superintendent of the Toronto Furnace & Crematory Co., died suddenly on March 14, aged 68.

Colonel Windle Pilkington, head of the famous St. Helen's glass firm, with branch factory at Thorold, Ont., died at Cannes, aged 74.

Frank Knowles, of the Goldie & McCulloch Co., Galt, has accepted a position with the D. McKenzie Machinery Co., of Guelph, Ont.

Joseph Oliver, former Mayor of Toronto, was elected President of the Canadian National Exhibition at the inaugural meeting of the Board of Directors.

Ward Curlee has been appointed city engineer of Swift Current, Sask., to succeed Geo. D. Mackie, who resigned recently. Mr. Curlee has been assistant city engineer for some time.

J. H. Larmoth, general manager of the Electric Power Co., Ltd., of Toronto, has been selected as the new superintendent of the Edmonton street railway, to succeed W. T. Woodrofe, resigned.

Sir Robert Perks, who has many Canadian financial interests, and warmly advocates the Georgian Bay Canal scheme, left London, Eng., with his son, Malcolm Perks, for Ottawa, on March 12.

Dryden, who has been manager of the Elmira Machinery & Transmission Co. for the past six months has resigned and will return to Galt. Harry Vice, son of A. D. Vice, former manager, will succeed him.

William G. Wright died in Toronto on March 10 after a long illness. Mr. Wright was born in 1847, and had been for 20 years in the employ of Bennet & Wright, Ltd., of which firm his brother is president.

Elzear Auger, a well-known shipbuilder and designer, 75 years of age, died on March 11 in Quebec. He was for a number of years dock superintendent to the Harbor Commission. He was also an expert yacht builder, and constructed a number of fast sailing yachts.

Stuart Wood, junior member of the firm of R. D. Wood & Co., manufacturers of cast-iron pipe and machinery specialties, died March 9 of heart disease at the home of his brother, Walter, in Philadelphia, Pa. He was born in that city in 1853, was educated at Haverford College and Harvard University, and later took a special course in philosophy at a college in Germany. At the age of 24 he entered the employ of R. D. Wood & Co., which was founded by his father.

WHO'S WHO.

WILLIAM NEWMAN.
Manager, Polson Iron Works, Toronto.

Toronto Branch, C.S.C.E.—About one hundred members and others attended the weekly luncheon of the Toronto Branch of the Canadian Society of Civil Engineers, when George G. Powell, Deputy Engineer of the city, gave a short address on "The Municipal Engineer." Mr. Lumsden of the Transcontinental Railway, and Mr. Hartsbury, Divisional Engineer of the C.P.R., were the guests of the society. Professor Gillespie, of Varsity, occupied the chair. Mr. Powell said that the municipal engineer's responsibilities were great, and he had to do a great deal for which he got no credit. His relation to the municipality was the same as a consulting engineer to a client. The difficulties met with in the municipal service were not always engineering ones, but rather obstacles such as the Local Improvement Act, money, and legal difficulties. The field of municipal engineering gave greater opportunity to a man than any other engineering field, owing to the diversity of the work. In the future, the sewer expert would be diligently sought after by municipal corporations, owing to the growing immensity of the problems in that line.

ATLANTIC VOYAGERS TAKE NOTE.

"She is the best and steadiest ship in a seaway I have ever been in. We have had very trying and heavy weather on both the outward and homeward passages, and she behaved splendidly. I can imagine nothing better afloat. You cannot say anything too good of the ship." Thus spoke Capt. Outram, the commander of the new Allan liner Alsatian, on the vessel's arrival at the landing-stage on completion of her first round trip.

On account of the heavy weather and fog experienced, no record runs were attempted, nor indeed would record breaking have been sought, as ships on the first voyage are judiciously "held back" somewhat. The Alsatian was slowed down a good deal owing to the above reasons, and her passage was naturally prolonged well over the time she would have normally taken in making the run across.

On the ship's arrival at Halifax, according to Mr. Green, the ship's purser, everybody in the "Liverpool of Canada" seemed to have turned out to witness her arrival, although she docked very early in the morning. During her stay at Halifax she was thrown open for inspection, and over a thousand people a day admired her splendid appointments, while the senior officers of the ship were invited to enjoy the full privileges of the Halifax and other well-known clubs, and treated generally as guests of the town. Capt. Outram was also the recipient of an illuminated address from the townspeople of his native place, Sydney, C.B., the address, it is interesting to note, being presented by Capt. James Townsend, who commanded, many years ago, one of the old Allan sailing vessels.

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Vol. XI. MARCH 19, 1914 No. 12

PRINCIPAL CONTENTS.

OUR CIRCULATION DEPARTMENT.

ATTENTION is drawn to the fact that the circulation department of this journal is in charge of Mr. J. I. Coddington, Ph.B., to whom all correspondence relating to non-receipt of any issue by subscribers, advertisers, etc., should be promptly sent. By so doing, the editorial department will not only be relieved considerably, but a more immediate rectifying of the trouble will be brought about.

EDITORIAL COMPLAINTS AND CRITICISMS.

OCCASIONALLY we are recipients of a complaint or criticism relative to editorial matter published, but for the most part these reach us in a more or less roundabout, indirect, and therefore, unsatisfactory manner; to wit, they rarely come direct. Let us say at once that we are not only at your service in the most direct manner possible to receive complaint and criticism, but lay claim as well to an average mortal's courtesy. Further, it is a common, every-day experience outside of the editorial feature of technical journalism, to find that an indirect approach contributes either to a distortion of facts or to an increase of fiction, or both; a set of circumstances not originally intended.

Bless you, no, we are neither infallible nor stubborn, nor are we in any sense unapproachable and inclined to aloofness. Let us get closer together then by eliminating the middleman, and you, Canadian Machinery and we ourselves will be all the better for it.

MATERIAL SUCCESS AND BENEFACTION.

HAS it ever occurred to you that the record of material success in the majority of cases spells only dismal failure for the individual concerned, in that his achievement was toward one direction, to wit, the selfish. There is everywhere in evidence a sharply defined distinction drawn between so-called successful men and he whom we term a benefactor of the race, and the distinction exists even although the former by the distribution of accumulated wealth,—the mark of success, seek enthronement later as a benefactor. We never associate with Edison or Westinghouse the statement that they have been successful inventors or successful business men; rather, do we in all cases speak of them as world benefactors, and speaking of these men whose work has been along a rugged pathway in which success and failure each filled an equally important place, we in the very nature of things overlook even if we happen to know of their failures, because we believe that personal success was not the paramount aim.

The toilers in our workshops and factories, in our offices, on our ships, on our farms, etc., although lacking the genius of Edison and Westinghouse, have the same conditions to meet, the same intermingling of success and failure, and who knows but a multitude of these in every age, by failing to achieve apparent material success have otherwise like these had bred in them something of more intrinsic personal worth and have accomplished an ideal, that entitles them to be reckoned as world benefactors instead

The passing of George Westinghouse marks the climax of a busy life, a strenuous fight against, in many cases, long odds. He gave to the world and humanity of his best, and even though his material wealth at his decease may run to millions, he gave more than he got in that respect. Inventive genius such as his was unlimited in its scope, and little wonder was it that on many occasions he was well nigh "broke." It has been said of him that capital could not keep pace with his genius. Accumulation of wealth and genius don't usually associate in us mortals, and it is perhaps just as well.

Courage consists not in blindly overlooking danger, but in meeting it with the eyes open.—Richter.

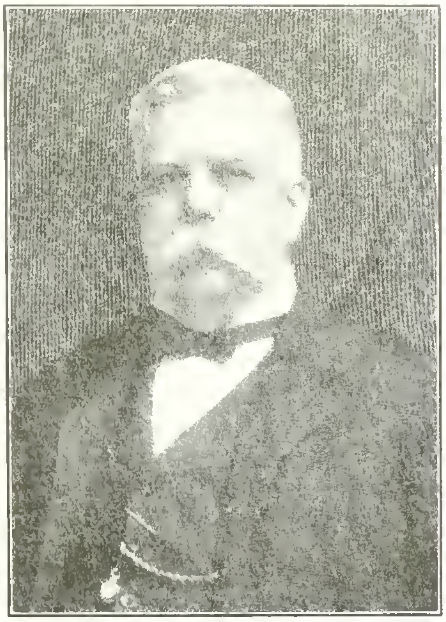
INDUSTRIAL NOTABILITIES--No. 26

GEORGE WESTINGHOUSE is dead. He was born at Central Bridge, N.Y., 68 years ago. His father was a machinist, and he spent much time in the shop, and at 15 he had invented a rotary engine. As a youth, he served in the Union army and navy in the civil war.

In 1865, he invented a device for replacing derailed steam cars, and in 1868 he, as a result of a railway wreck he had witnessed, produced the famous air brake, which is claimed to have saved more lives than Napoleon lost in all his battles.

He had to fight hard to get it even tried on a railroad, for when old Commodore Vanderbilt was applied to and heard that the applicant proposed to stop railway trains with wind, he said curtly that he had no time to waste on fools. Westinghouse was then just out of his 'teens.

The first train stopped by the brake stopped so quickly that it was wrecked in the process. As the story goes, Westinghouse climbed upon the engine cab just before the start, grasped the engineer by the hand, and whispered to him: "All I ask is a fair show," and jumped off.



GEORGE WESTINGHOUSE.

He got his fair show, but many more weeks of hard work were found necessary to perfect the invention so that the brake would act simultaneously upon all the cars of a train.

The generation of power at Niagara and electrical development generally is largely associated with the work and enterprise of Westinghouse.

He was literally a horny-handed son of toil, for his hands were hardened and seared from much contact with tools and metal. Those who knew him best called him "the man who worked." He had to meet financial difficulties more than once after becoming famous as an inventor and manufacturer, but overcame them, and a few years ago his personal fortune was estimated at $50,000,000. His wife, whom he married in 1867, and one son, George Westinghouse, Jun., survive him.

Paule Latzzke in an article in Everybody's said of him:

"Simple as a child with his friends, cheerful, plain, unaffected, democratic to the last degree, yet strong as a lion. A man of huge proportions and the strength of an ox, standing six feet in his stockings, yet so gentle in disposition that no one has ever seen him angry; simply 'impatient.' He never asks anyone to do a thing he would not do himself. He is a tremendous fighter, but always fights fair. He is generous to a fault."

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3....	19 50	20 00
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3.......	19 50	20 00
Clarence, No. 3........	19 50	20 00
Jarrow	.....	23 50
Glengarnock	......	26 00
Summerlee, No. 3......	22 00	.....
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1........	19 00	18 35
Victoria, No. 2X.......	18 75	18 10
Victoria No. 2 Plain...	18 50	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh.........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal......	2.10
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh.....	1.20
Steel hoops, Pittsburgh..........	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ in., 100 lbs...	$2 30	$2 20
Heads, per 100 lbs.......	2 55	2 55
Tank plates, 3-16 in......	2 60	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	9 00	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate Washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb off
Nuts, Hexagon, all sizes..	4½ per lb off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright	85, 10, 7½, 10, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, bronze	70, 10, 7½, 10 p.c. off

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in...	75%
Finished Nuts over 1 in....	72%
Semi-Fin. Nuts up to 1 in..	72%
Semi-Fin. Nuts over 1 in...	72%
Studs....................	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncre'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings..	9 00	9 00
No. 1 wrought iron.....	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	13 00	12 00
New brass clippings....	8 50	8 75
No. 1 brass turnings....	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$. 32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	.....	.....	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in. ..	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$16 00	$15 75
Electrolytic copper	15 50	15 25
Casting copper	15 00	15 00
Spelter	5 25	5 25
Tin	40 50	41 00
Lead	5 00	5 30
Antimony	8 50	8 50
Aluminum	21 00	19 00

SHEETS.

	Montreal.	Toronto.
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4.30	4.10
Queen's Head, 28 B.W.G.	4.40	4.20
Fleur-de-Lis, B.W.G.	4.20	4.20
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.40	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal.	0.22
Pure turpentine	0.69
Linseed oil, raw	0.60
Linseed oil, boiled	0.63
Plaster of Paris, per bbl	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

THE BUSINESS OUTLOOK.

USUALLY the middle of March sees more activity in business, but the seasonal movement, generally speaking, is much lighter than a year ago. Orders and inquiries are neither as large in volume nor as pressing as is usual when the winter shows signs of breaking. In Ontario and Quebec business is far from normal, and this condition will obtain until the industrial situation clears up.

Industrial balance sheets are disclosing a state of affairs no better than anticipated, and one manufacturing house, the balance sheet of which will not be issued for three months, has been commendably frank in stating that business will be much below the previous year's standard both as to profitableness and as to volume.

If reports as to the decision of the Government to guarantee bonds of the C.N.R. are true, they will be a factor in clearing up the business outlook. Just as soon as the Government's decision is made law, the Canadian Northern will be compelled to place orders for at least $8,000,000 of new rolling stock. This will go to Canadian firms. There still remains, however, the unsatisfactory position of the National Transcontinental Railroad. It is as necessary to get this line into commission as to complete the Canadian Northern System.

Montreal, Que., March 16, 1914.—Will the Federal Government at Ottawa listen to the request of Mackenzie and Mann for assistance in completing the Canadian Northern Transcontinental Railway? This is a question in which the public is taking a lively interest just now. Opinion in Montreal seems to be sharply divided on the subject, most people being of opinion that the C.N.R. has perhaps already had as much public aid as it deserves. There is no doubt, however, that should the Government agree to guarantee the C.N.R. bonds the business outlook will be considerably cleared up. Just as soon as a favorable decision is reached, the Canadian Northern will have to place orders for much new rolling stock, a large proportion of which would doubtless be built in Montreal.

In future the Marine Department at Ottawa plans to advance the opening of navigation on the St. Lawrence very materially, and with this end in view has just let the contract for a large ice-breaker, 275 ft. long, 56½ ft. wide and 32 ft. deep. Her engines will develop 8,000 I.H.P. and she will, it is said, be the largest and most powerful craft of her kind in the world. The Canadian Vickers Company is said to have secured this important contract and the vessel will be constructed at their Montreal yards. The contract price is understood to be nearly a million dollars.

The Marine Department plan to put the ice-breaker at work at the Cap Rouge ice bridge each winter, to prevent the undue accumulation of ice, and the vessel will afterwards work between there and Montreal in conjunction with the Montcalm and the Lady Grey. Not only will the opening of navigation be greatly advanced, but the spring floods along the St. Lawrence will be much reduced or altogether obviated.

Metal Markets.

The pig iron movement that made itself felt a few weeks ago has died down. Buying was at all times cautious, and the recent slight advance in prices has apparently resulted in killing what little life there was in the market.

There has been a slight drop in the price of electrolytic copper and pig-lead is a trifle easier; but otherwise, prices remain unchanged. The old metal market is extremely quiet.

Toronto, Ont., March 17, 1914.—As far as can be ascertained there appears to be a general impression that the tide is turning, and that better conditions may be anticipated in the near future. It cannot be said that there is as yet any pronounced improvement to be recorded, but indications point to an increased volume of business with better prices, although the recovery may be slow in materializing. The improvement anticipated will depend to a great extent upon the condition of the money market, which at present is weak.

One favorable feature in the steel market is that prices are showing a decided tendency to stiffen, and we are informed from a reliable authority that the producers who supply a large part of the steel for Canadian consumption are determined not to sell below cost. This indicates that there will be an upward tendency when the demand increases, which should take place soon, for, with better weather conditions, there will be increased activity in the building trade. The number of inquiries for structural shapes is gradually increasing, and in this respect we might say that the improvement was normal, although no large orders are being booked and prices have not changed.

Pig iron is still weak, the demand being light and few sales recorded. Stocks are getting low, and will need replenishing; it is, therefore, reasonable to suppose that the iron market should become stronger at no distant date.

The demand for tool steel and machine shop supplies continues fair, with improving prospects.

The improvement noted last week in the machine tool business has been maintained, the outlook if anything having improved. Inquiries are more general, although specifications are light. An inquiry has been sent out by the C.P.R. for a number of new tools for the steel car shops at Montreal, the list being given in our industrial columns. This is the only specification of importance that has been received here during the week. A local firm of dealers report having sold a number of machine tools to the Patent Selling Co. and the Children's Hospital, both in this city. In the former case all the tools were equipped with motor drives. Another firm report having sold a Brown & Sharpe milling machine to a local concern.

No change can be reported in the metal market this week, the general condition being quiet, with prices firm and orders to small specifications only.

Ottawa, March 17, 1914.—Speculation is still rife here as to the outcome of the two big questions of the day, in which the business and financial world are particularly interested—tariff changes and aid to the Canadian Northern. It will be a week or more yet before there is anything official on either of these questions.

During the past week two efforts were made to draw the Government on its attitude on tariff changes. Mr. J. J. Carrick, member for Thunder Bay and Rainy River, asked assistance for the iron and steel industry, pointing out that it was now in a very depressed and languishing condition. The policy he advocated was a bounty of $1 a ton on all iron ore mined in Canada. W. E. Knowles moved a resolution asking that agricultural implements be put on the free list. In both cases the members were informed by the Government that there would be no announcement until the budget was brought down, and that in the meantime the matter would be given the most serious consideration.

The Government is keeping its own counsel, and absolutely nothing will be definitely known until Mr. White rises on Thursday afternoon, March 26 and introduces the budget. Your correspondent, however, is informed on very good authority, though, that both requests will be at least partially granted. It is believed that the steel industry will be given some assistance, though not in the form of bounty. The assistance will be increased duties on certain items, such as wire rods, etc. On the other hand there will be a substantial cut in the duty on agricultural implements from the present duty of 17 per cent. to 10 per cent. This is the present plan and there is every reason to believe that it will be the announcement which Mr. White will make. As to just how far the assistance to the steel industry will go no one knows.

As for the C.N.R. question, it is still more or less in status quo. The C.N.R. have made formal application to the Government for a bond guarantee. The application was accompanied by an elaborate memorandum expressing the reasons why the C.N.R. believed they were entitled to aid. The amount has not been named. This is left to negotiations. A sub-committee of the Cabinet has had the matter under consideration

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St. John, N.B., March 14, 1914. — While business continues quite prosperous and encouraging with Maritime Province industrial houses, there does not seem noticeable the same stir of activity which has characterized other seasons at this time of year. Orders with most houses are being received well up to standard, but talk of new buildings or additions, enlargements, etc., is not so commonly heard as at other times. However, most managers of the large industrial houses are looking forward to a successful year.

So far as St. John is concerned, business keeps well up to the average, and there is still talk of new industrial establishments. Whether or not they will materialize cannot, of course, be definitely said as yet, although it is fully believed that after the snow has cleared from the ground there will be a movement in this direction. The different buildings now in the course of erection are well advanced. The E. G. M. Cape Company has started the preliminary work preparatory to actual construction of the new wharves at Sand Point, west side. One of these wharves is to be 850 feet long, the other 600 feet.

A new factory is to be built at Moncton by the J. A. Marven Co., who will vacate their present premises and erect a plant immediately east of the Havelock Mineral Springs building. The structure will be fireproof, of concrete and brick, and will be about sixty feet by one hundred and forty. It will probably be a four-storey building.

A fifty-ton sulphite pulp mill is to be erected at Bathurst, N.B., by the Bathurst Lumber Co. Work is to be started immediately, and early next year it will be possible to purchase for the first time a domestic product of the highest grade cook-bleached mitsherlich sulphite paper. The mills will be operated under the name of the Bathurst Pulp and Paper Co., Ltd., with a capitalization of $3,000,000. Angus McLean, general manager of the Bathurst Lumber Co., will be president, and A. G. McIntyre, editor of the Pulp and Paper Magazine, and a former St. John boy, will be manager. The company owns 2,800 square miles of limits extending from the plant itself.

Negotiations which have been pending for the purchase of the Yarmouth (N.S) Light and Power Co. have terminated in the acquisition of that concern's plant and interests by the New England Light & Security Co

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Algoma Steel Corporation.—The Canadian Agency circular says that contracts have been let for the completion of the existing battery of open-hearth furnaces of the Algoma Steel Corporation. This will involve the addition of two new furnaces and a mixer, bringing the capacity of this particular plant from 15,000 to 20,000 tons of ingots a month.

UNION CARBIDE CO. PLANT, WELLAND, ONT.

Representative of an investment of over a million of dollars, the Welland plant of the Union Carbide Co. is now nearing completion. The expedition with which the construction of this plant has been carried out by the Lackawanna Bridge Co. is worthy of comment. Ground was broken on October 1st, 1913, and at the present time some of the machinery has been installed, while practically all of the buildings are ready for the official opening on April 1, 1914.

Some idea as to the extent of this new plant can be obtained from the following facts: Site—forty acres; Railroad sidings—two miles; Factory buildings—eight; Employees—Three to five hundred; Annual wage roll—Approximately three hundred thousand dollars; Private systems—Water, sewerage, filtration.

Buildings.

The various buildings are as follows: The lime kiln building, 360 by 66 feet, is of one storey and of steel construction, with corrugated iron roof and walls; the furnace building, two storeys, 280 feet by 76 feet; the mixer building, two storeys, 66 by 28 feet; the storage building, one storey, 180 by 60 feet; The machine shop, office and drum factory building, two stories, 260 by 60 feet, of steel and brick with cement tile roof. The three-storey packing building, 140 by 76 feet, the one-storey cooling building, 180 by 68 feet, and the two-storey terminal building, 120 by 45 feet, are of similar construction.

The Product.

The product of the Company is calcium carbide, and the procedure of raw material from the railroad cars to the finished article is modern in every respect. The railroad cars with raw material enter the lime kiln building over an 800-foot trestle, and are dumped into their various bins. From these the material is sent over to the furnace building by belt conveyor. After passing through electric furnaces it is conveyed to the cooling building by electric cars, thence to the packing building where the product is crushed, and placed in drums and forwarded to the storage building ready for shipment. The drums for shipping finished product are manufactured in the drum factory building on the ground floor. The drum storage is on the second floor, where surplus empties are stored, these being conveyed as required over to the packing building with trucks via a steel bridge. All the buildings are connected with closed steel bridges.

John White is general superintendent of the plant with R. C. Thompson as works superintendent.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Lachine, Que.—The town may build and equip a new pumping station this year.

Toronto, Ont.—The Canada Foundry Co. pipe shop has shut down for an indefinite period. No reason was given for doing so.

Hamilton, Ont. — A new company known as the Hamilton Specialty Mfg. Co., Ltd., will establish a plant here for making lock nuts and other specialties.

St. John, N.B.—T. McAvity and Sons, Ltd., are planning an immediate outlay of $300,000 upon their new plant, including brass and iron foundries.

Montreal, Que. — The Hawley Down Draft Furnace Co., Easton, Pa., is installing three of its down draft smokeless furnaces in the Peace Centennial School here.

Newcastle, N.B.—A company is being formed to manufacture a new weighing scale patented by Mr. E. G. Hedman of Rosebank. The new factory will probably be built here.

Toronto, Ont.—A building permit has been issued by the city architect to the Canada Metal Co. for the erection of a one-storey brick addition to their factory on Fraser Avenue, near King Street, costing $7,000.

Quebec, Que.—The Canadian Northern Railway is about to erect a large coal-discharging plant at this port, as well as extending its coal wharf 150 feet, making it sufficiently large to hold 12,000 tons of coal.

Redcliff, Alta.—Mr. Corson, manager of the Ornamental Iron Co., states that they expect to close a contract in a few days for a very large order of ornamental iron, and that it will mean an increase of their working force.

Steelton, Ont.—The Algoma Steel Corporation will build open-face furnaces. Tenders for building and equipment will be in by May 1. Gas engines, motors, air compressors, blowers, boilers, cranes, etc., will be required.

Ottawa, Ont.—It is considered probable that the Beach Foundry Co., of Iroquois, Ont., will move their plant here. It is reported that the company have amalgamated with the Butterworth Foundry and that the operations of both concerns will be extended.

Woodstock, Ont. — The Woodstock Water and Light Commissioners are considering the question of installing water meters in all larger residences, stores and public buildings. It is estimated that a considerable saving can be effected by this means.

Fort William, Ont.—W. H. Osborne, president of the Wisconsin Malleable Iron Company, has been in conference in Chicago with John Crerar, of Crerar, Clinch & Co., on the subject of a branch plant at Fort William, Ont. Mr. Osborne has been looking into freight charges on raw material to Fort William.

MACHINE TOOL REQUIREMENTS.

The C.P.R. are in the market for the following equipment for their new steel car shops, Montreal:

- **Plate Straightening Rolls.**
- **Power Cornice Brake.**
- **High Speed Sensitive Drill.**
- **Circular Shears.**
- **Plate Squaring Shears.**
- **Plate Bending Rolls.**

Waterford, Ont.—A factory in Waterford has been purchased by the Universal Chemical Electric Co., which is composed principally of Brantford capitalists, with Albert J. Jacobs as general manager. The company will manufacture telephones and supplies, electric fixtures, magnetos, dry-cells, electrical sundries, etc.

Penticton, B.C. — Councillor Mutch gave notice that at the next meeting of the council he would introduce a by-law for the installation of another Deisel oil engine and an additional generator at the power house. Boving & Co., of Vancouver, have written, stating that they would guarantee to install a 200-h.p. Deisel oil engine by the beginning of November.

Winnipeg, Man.—It is likely that a new contract will be entered into with the American Well Works Co., of Aurora, Ill., for the purchase of three new pumps. The contract, if awarded, will probably be on the terms that the contractors must take the responsibility of the pumps working satisfactorily. The pump now being tested is in well 25, and is pumping over 800,000 gallons per day.

Pembroke, Ont.— The town council are negotiating with the Electrical Mfg. Co., of Canada, who desire to build a factory here. The company will erect buildings and machinery to the value of $200,000. A fixed valuation for municipal taxes at $25,000 for ten years has been granted, and in return, the company guarantee that $200,000 worth of stock shall be taken up in cash before they start operations.

Swift Current, Sask.—The new power plant, which has been erected on a portion of the industrial site recently purchased by the city, was put in operation on March 10. A 200-watt unit is being used to develop power for the present, but a 400-watt unit will be installed this summer. The main business thoroughfares of the city were lighted by the new five-cluster lights set on ornamental iron standards.

Winnipeg, Man. — A plant has been built and equipped by the O-Rib-O Mfg. Co., at 233 Spadina ave., for the manufacture of sheet metal products, including stove piping, and stove pipe elbows, garages, refrigerators, and hot air furnace requirements. The plant at present measures 48 x 70, and will be increased to 50 x 150 shortly. John Broekest, of Clare & Broekest, May street, Winnipeg, is president.

Medicine Hat, Alta.—Plans for the new radiator plant to be built south of the city's industrial site by E. L. Carey Wright, are being prepared by H. A. E. Brown, architect. The plant will occupy a building 288 feet by 80 feet, including the foundry, machine shop, warehouse and core room, and there will also be a store house 20 feet by 95 feet, and a small office building separated from the main building.

Alliston, Ont.—The town of Alliston voted on a by-law on March 12, in favor of the Dominion Gas Tractor Co., to give it a free site, a fixed assessment of $2,000, and free water for ten years. The by-law carried by a vote of 243 for and 4 against. It is understood the Dominion Gas Tractor Co. will proceed to erect a building at once, and will manufacture gas traction engines for use principally on farms in the West.

Edmonton, Alta.—Representatives of the firm of Smith, Kerry & Chase, Ltd., of Toronto, are making an inspection of water power in Athabasca River at Grand Rapids, Alta., with a view to erecting a plant, estimated to cost from $5,000,000 to $10,000,000. The lease of the site is held by H. W. Adcock of Winnipeg. J. S. Kerry, a member of the Toronto firm, says that it will be possible to transmit power from the Rapids to Edmonton, 175 miles distant.

Victoria, B.C.—Further additions to the Jordan River plant of the Vancouver Island Power Co., will be commenced within a short time to provide for the third unit. This will bring the aggregate capacity of the plant to 25,000 horse power and complete the installation of the 13,000 horse power increase authorized to the original plant of 12,000 horse power. The machinery is already on the ground and as soon as the building, to cost about $75,000, is complete, the plant can be installed.

Electrical

London, Ont.—Excavation work for the addition to the Horton Street hydro plant will be commenced at once. The plans have been completed, and the building will be constructed by day labor.

Islington, Ont.—Etobicoke Township Council and Weston Hydro-Electric Commission held a conference on March 9, in the council chamber at Islington. Negotiations were made for several electric extensions in the township.

Kelowna, B.C.—The Belgo-Canadian Fruitlands Co., have submitted a proposition to the council to supply the town with light and power from a hydro-electric plant, which they would install on their property at Mission Creek.

Petrolea, Ont. — Hydro radial meetings under the direction of Mayor Stirrett, representative of the county council for hydro matters, have been arranged as follows: Brigden, March 12; Courtwright, March 16: Sarnia, March 19.

Galt, Ont. — The report of the Galt waterworks superintendent shows an increase of over a million gallons pumped in February as compared with the same month last year, but a decrease in the cost of $32, owing to the employment of hydro-electric power.

Toronto, Ont.—The Toronto Electric Light Co. propose constructing underground conduits and placing wires therein on the following streets: Intersection of King and Yonge; Victoria street, opposite Loew's theatre, and south-west corner of Jordan and Melinda streets.

Owen Sound, Ont.—At a special meeting of the town council and the Board of Trade, called last Thursday, a local branch of the Ontario Hydro-Electric Union was organized. The project has been fathered by the secretary of the provincial association.

Toronto, Ont.—The townships wanting the Toronto, Markham & Port Perry electric radial from the Provincial Hydro can have it as soon as they vote in favor of the scheme. All the details are ready and the surveys and bills of material in order.

Kincardine, Ont. — A proposition is under consideration to do away with the present arc lights and substitute incandescent lights. Engineer Ingram's estimate of the cost of installation is $2,500. The matter was left over for further consideration by the council and commissioners.

St. Mary's, Ont.—The Water, Light and Heat Board, has received from the Hydro-Electric Commission its recommendation concerning the proposed changes in the street lighting system. Engineer Caster recommends that the present arc lights be replaced by 80 c.p. tungsten lamps. The cost of the change is estimated at $10,000.

Guelph, Ont.—At a meeting of the city council on March 16 a resolution was adopted asking the Hydro-Electric Power Commission to investigate and report on a proposition to construct hydro radial lines from Guelph to Hillsburg and Erin and through the Townships of Eramosa and Erin to Orangeville. A request will be made for a statement of costs, probable revenue, etc.

St. Mary's, Ont.—Mr. Mooney, Stratford, is arranging for a hydro-radial meeting at Stratford, this week, to further the interests of hydro-radial lines in western Ontario. Delegates are expected to be present from Goderich, Clinton, Seaforth, Dublin, Mitchell, Fullarton, Monkton, Atwood, Listowel, Millbank, Milverton, New Hamburg, Baden, Wellesley, New Dundee, Plattsville, Tavistock, St. Mary's Exeter, Hensall and other places.

Municipal

Sherbrooke, Que.—The town of Bedford will build several miles of new roads this year and will require road machinery.

Barrie, Ont.—At the meeting of the Board of Works of the town council held on Wednesday, March 4th, the matter of the purchase of a horse-sweeper was taken into consideration.

Calgary, Alta.—The Council will recommend expenditure of $300,000 on extensions to the electrical plant.

Medicine Hat, Alta.—The city council is spending $65,000 on machinery and equipment for a municipal power station.

Welland, Ont. — Welland County Council on March 11, decided to build 34 miles of the county good roads system by contract this year, in addition to the twenty miles it is estimated will be built by the three county outfits.

Chatham, Ont.—According to information received in the city from the Hydro-Electric Commission, the Chatham Gas Co. has withdrawn its offer of $410,000 for the sale of their plant to the city.

Port Arthur, Ont.—The request from the Board of Trade for a grant of $3,500 to carry on the publicity work of the city was again turned back to the finance committee at a meeting of the council recently.

Berlin, Ont.—The Industrial Committee, consisting of members of the city council and Board of Trade, have asked the city council to make a grant of $1,000 toward establishing an industrial Bureau, on condition that the citizens contribute $1,200 annually for a period of three years.

London, Ont. — The members of the Board of Health are of opinion that the only solution of the meat problem is the establishment of a municipal abattoir. The action of the board in putting only $2,000 in its estimates for meat and milk inspection does not indicate that the proposal for a civic abattoir has been abandoned.

Ottawa, Ont. — City Engineer Currie has explained, in answer to questions put to him by Ald. Fisher, that a mechanical filtration plant such as he reported upon for Mayor McVeity would cost $1,400,000 if the supply were to be only twelve million gallons a day. The annual cost of operation and the fixed charges of this would amount to $160,000 a year.

Hamilton, Ont.—The officials of the works department are busily engaged in preparing plans for the sewage pumping station it is proposed to build north of the Jockey club, and also on plans for the extension and improvement of the Trolley street disposal plant, so that it will be capable of handling all the sewage of the east end and in a more up-to-date manner than at present. The total cost of these works will be about $110,000. The council has yet to authorize the work to be started.

Regina, Sask.—Seven money by-laws involving a total expenditure of $1,441,000, will be submitted to the burgesses on March 18, for the following: Storm sewers, $170,000; waterworks extensions, $360,000; light and power generation, $244,000; hospital extensions, $175,000; street railway extensions, $250,000, light and power distribution, $160,000; sewage disposal works extension, $82,000.

Prince Rupert, B.C.—Steps are being taken to conduct a big publicity campaign in view of the opening of the Panama Canal next year. It is the intention to rush buildings under construction to completion by that time, representing an aggregate of approximately six million dollars. It is expected that an effort will be made to have the city and its resources represented at the fair.

Kingston, Ont.—J. V. Lyon, Guelph, secretary of the executive committee of the Great Waterways Union of Canada, and Controller T. L. Church, Toronto, will go to Kingston to address a meeting of the city council and board of trade in connection with development of hydro-electric power and radials in eastern Ontario and the deepening of the St. Lawrence and Welland Canals.

Nelson, B.C.—Voting on the municipal by-law on March 4, to decide if the City of Kaslo would purchase the lighting plant of the Kootenay Electric Co., resulted in the voters of Kaslo indorsing the purchase. Only eleven votes were recorded against the purchase. The price to be paid is $27,500, the purchaser to take fifteen thousand dollars in twenty-year bonds at six per cent.

Port Arthur, Ont. — The Provincial Board of Health has promised that pressure would be brought to bear on Fort William to establish a sewage disposal plant as soon as that city made application for additional sewer outlets. This would prevent raw sewage being dumped into the bay from Fort William, when Port Arthur was compelled to treat their sewage.

Sault Ste. Marie, Ont.—At a meeting of the town council on March 9, the matter of having a clause inserted in the private bill now before the Legislature to enable the city to extend the time for the commencement of building operations on the dry dock was referred to the By-laws and Legislation Committee, which will probably report to a special meeting of the council later.

Toronto, Ont. — Mayor Hocken told the Board of Control that he had instructed General Manager Couzens of the Civic Hydro Commission to investigate the value of the Interurban Electric Co. plant, franchise and business within the city limits. The purchase was suggested by the Provincial Hydro-Electric Commission. The board decided to await the report of Mr. Couzens before taking further action.

Windsor, Ont.—The council has decided to purchase an incinerator from the Toronto Furnace & Crematory Co., at a cost of $23,700; the incinerator to have a capacity of 25 tons per 24 hours. Other firms tendered as follows: Canadian Griscom-Russell Co., Montreal, $18,400; the Decaire Co., Minneapolis, $25,000; Heenan & Froude, through their Montreal representatives, quoted $40,000 for a 50-ton plant.

Winnipeg, Man.—A scheme is being considered for supplying Brandon, Portage la Prairie, Carberry and Virden with current from Point du Bois. It is estimated that the cost of constructing transmission lines, sub-stations, etc., would be about $1,000,000, and that unless 20,000 h.p. could be disposed of, the proposition would not pay. A committee has been appointed to investigate.

Sault Ste. Marie, Ont. — The town council are considering the purchase of an incinerator. The Sanitary Committee reported that after considering both incinerator and reduction plants for the disposal of garbage, they recommended that a contract be given to the A. H. Reid Incinerator Co., to construct a plant to cost $14,000, to be erected on the city's Spring street water lot. The incinerator would have a capacity of 15 tons in 24 hours.

Kingston, Ont. — An offer for cheap power has been made to the city by Boyd Caldwell, Lanark, who presented his proposal to Mayor Shaw and T. J. Rigney, chairman of the civic utilities commission. The proposal is to sell the falls on Madawaska River at Calabogie for the generating of electric power. Caldwell claims that from his property can be generated a minimum of 6,000 h.p. for continuous service. The falls are ninety miles from this city. The matter will be taken up by the civic utilities commission.

Toronto, Ont.—Works Commissioner Harris has had plans prepared for the proposed widening of Main Street between Gerrard Street and Danforth Avenue. One plan, providing for a 5 per cent. grade in the approaches to a subway under the Grand Trunk tracks, in place of the existing bridge over the tracks, will cost, exclusive of land damages, about $207,750. Another plan, with a grade of about 3½ per cent., will cost $288,500. Mr. Harris favors the former scheme, and expresses the view that the cost of the improvement should be borne by the city at large.

Building Notes

Belleville, Ont.—At Belleville construction work to the value of $5,300 has been undertaken during the past month.

Lethbridge, Alta.—Lethbridge building returns for last month total $10,200, or slightly less than the February figures last year.

Montreal, Que.—A new $100,000 school will be erected by the Catholic School Commissioners at the corner of Fairmount and Bloomfield streets, for which Mr. Jos. Godin is the architect.

Montreal, Que.—E. & W. S. Maxwell are architects for the new Marcil Trust building, to be erected on the site of the old Herald building, the plans for which have not yet been announced.

Fort William, Ont.—It was decided at a meeting, held on March 9, of labor men of the city, to commence the erection of a Labor Temple in the near future. The new building will cost $25,000.

Montreal, Que.—C. A. Reeves is architect for a new police and fire station to cost $96,000 to be erected in Bordeaux Ward, while other stations will probably be built in St. Ann's, Notre Dame de Grace, and Longue Pointe wards.

Quebec, Que.—A slight drop in the value of building permits for February is reported from Quebec City; but for the two months of this year the figures compare favorably with last year, being $97,850 as against $50,300.

Halifax, N.S.—Halifax has been showing signs of structural development, the building figures for February being $14,380, as against $6,500 for the same month of last year. This brings the total for the present year to $25,590.

Montreal, Que.—Telephone exchanges are already under erection in Outremont and Point St. Charles, and another is expected shortly to be built between Clark and St. Urbain streets on Ontario street.

Toronto, Ont.—The City Architect's Department have issued a permit to Soren Bros. for the erection of a four-storey brick factory on King street west, near Spadina avenue. The new structure will cost $42,000.

Montreal, Que.—It is stated that a hippodrome will be built here. It will be modeled after the hippodrome at New York, and provide high-class vaudeville at popular prices. The arrangements are in the hands of L. B. Totens, acting for a New York syndicate, who plan similar ventures in Toronto, Vancouver, and Winnipeg, and it is stated work will be commenced on all of them in the spring.

Trade Gossip

The Polson Ironworks, Toronto, launched a dump scow on March 11. The vessel is one of three being built for the Quebec Harbor Commission, and is 150 ft. long, 40 ft. beam, by 15 ft. deep.

Fraser & Chalmers of Canada, Ltd., 4 Phillips Place, Montreal, have been appointed Canadian agents for W. H. Allen, Son & Co., Bedford, England, builders of steam, hydraulic, and electrical machinery.

The E. J. Woodison Co., Toronto and Detroit, advise us that they have completed the installation of a buffing composition plant, and that they contemplate making all kinds of buffing composition of the highest grade, including Woodison crystal finish for nickel on brass and nickel on iron, tripoli, corcus, emery cake, coloring composition, etc. They are also placing on the market a metal rim riddle with an adjustable bottom, or refill. The riddles are being made in both 18-in. and 20-in. sizes and with both galvanized and brass bottoms or sieves.

Winnipeg, Man.—At a Council meeting on March 9 two big contracts were awarded, one of $130,000 for steel pipe to the Canadian Steel Pipe Co., and one of $51,720 for the laying of the pipe to the Hurst Engineering & Construction Co. The pipe is lock bar, and of the total amount of 24,000 feet, 4,000 feet is to replace the wood stave pipe between well 8 and well 10, while the balance is to replace the present 18-inch cast iron pipe between well 8 and the reservoir. The Hurst Engineering Co. was the lowest of four tenderers for laying the pipe, and work will be commenced at once.

Bounty on Iron Ore.—R. R. Gamey in the Legislature has given notice of a bill under which he hopes to secure the re-establishment of the bounty on iron ore mined and smelted in Ontario. Under present conditions, iron is brought in from all parts of the world to the disadvantage of Canadian industry, and it is anticipated that if the bounty were re-established of, say, $2 a ton on the pig product, it would result in the erection and creation of smelters in different parts of the province, involving an expenditure of several millions of dollars.

To Share Profits.—Manager E. G. Henderson, of the Canadian Salt Co., with plants at Windsor and Sandwich, Ont., has announced that his company will immediately start a profit-sharing plan with its employees. While not so pretentious as the plan of Henry Ford, nearly one hundred men will get 5 per cent. on the wages earned in a year. Employees who have been with the company one year are eligible to participate in the plan. There are a large number of girls employed in packing the products of the company, and these will also share in the profits.

Toronto, Ont. The building permit for the new Methodist Book and Publishing House, to be erected on the block bounded by Queen, John and Richmond streets, has been issued by the City Architect's Department. The permit calls for the erection of a five-storey brick concrete and terra-cotta building strong enough to carry a load of another five storeys, which may be added some time in the future. The cost of the building, according to the contracts, will be about $600,000. The John H. Parker Canadian Co. are the builders, while Burke, Horwood & White, of this city, are the architects.

Anticipated Tariff Changes.—With the Budget speech coming some two weeks hence, rumors of tariff changes are beginning to be whispered in the Government ranks. There is a well-defined belief that there will be a reduction of the duty on agricultural implements to 10 per cent., the present duty being 17½ per cent. This will be the Government's attempted compromise with the farmers. It is expected that the Government will also do something for the iron and steel industry. It is not believed, however, that there will be any very drastic change in the present iron and steel schedule, but some minor changes calculated to help the industry are known to be contemplated. The whole question will probably be threshed out at a party caucus to be held before the Finance Minister makes his Budget speech. It is practically certain that free wheat and free flour will not be granted this session at least.

Investigate Canadian Iron Resources. —Following up a discussion on the present status of the iron industry in Canada, a resolution was proposed at the March 6 session of the Canadian Mining Institute by Mr. Eugene Coste, seconded by the President-elect, Mr. G. G. S. Lindsey, K.C., and carried, directing the attention of the Dominion Government to the fact that the iron industry was greatly handicapped because extensive deposits of the same high grade as were found in the United States, Newfoundland and Cuba had not yet been located in Canada, although it was believed that they existed, and that they could be found were endeavors made. The Institute, therefore, urged the Government to take such means through the proper channels either by a geological survey or by a special committee of experts, as would determine the extent and value of Canada's iron resources, a procedure which would add immensely to the economic wealth of the Dominion.

Catalogues

The Gridley automatic multiple spindle drill is dealt with full in a catalogue which we have received from the Windsor Machine Tool Co., Windsor, Vt. A general description is given of this machine, in addition to illustrations showing tools in position for various operations, and specimens of work produced by the Gridley drill.

The H. E. Barton Tool & Supply Co., Chicago, have sent us a number of leaflets dealing with the electrical tools manufactured by the Stow Manufacturing Co., Binghampton, N.Y. The leaflets cover portable electric breast drills, tool post grinders, bench grinders, etc. A specification, together with illustrated description, is given for each type.

Morris type "P" swing jib-crane is the subject treated in a bulletin recently issued by the Herbert Morris Crane and Hoist Co., Toronto. The illustrations include views showing the jib-crane in operation and different types of worm gear chain-blocks used with these jib-cranes. The last page shows a diagram of jib-crane with table giving principal dimensions for each size.

"McLain's system," Milwaukee, Wis. are distributing a pamphlet dealing with the McLain system of producing semi-steel. The pamphlet contains for the most part private correspondence between David McLain and A. J. Witt, general manager of the Cumberland Foundry and Manufacturing Co., Nashville, Tenn., regarding the introduction of the system in the latter plant.

Heating Feed Water With Exhaust Steam is the title of Catalogue No. 51, recently issued by the National Pipe Bending Co., New Haven, Conn. The catalogue deals with heating feed water and the advantages of a closed heater, followed by a description of the "National" heater, and accompanied by several exterior and interior views showing the general construction. Tables are included, giving the dimensions and weights of the various sizes.

Ronald Trist & Co., Ltd., London, Eng., have sent us a smart-looking bulletin dealing with the "Thermo-feed" Differential Pump Governor which they manufacture. A comprehensive description is given of the governor, with special reference to its principal features, together with an excellent illustration. A leaflet containing the working details is enclosed with the bulletin. The leaflet shows a sectional view of the "Thermo-feed" Governor, each part being numbered, and its method of working de-

scribed very clearly. Copies may be obtained by writing.

McLain's Semi-steel is the title of a catalogue which has been issued by McLain's System, Milwaukee, Wis. The catalogue contains principally a number of testimonials from firms who have adopted the McLain System in their foundries. There are also several pages devoted to foundry practice, and the advantage of producing semi-steel castings, together with illustrations showing castings of various kinds made of this material.

Baldwin-Westinghouse Electric Mine Locomotives is the title of Catalogue No. 1525, published jointly by the Baldwin Locomotive Works, Philadelphia, Pa., and the Can.-Westinghouse Co., Ltd., Hamilton, Ont. Very clear illustrations are given showing the principal constructional features of the locomotive, while the reading matter describes the details fully. There is also a table and two curve diagrams covering the mechanical performance of this type of locomotive of various capacities. The catalogue concludes with a number of specification sheets to be filled in by prospective customers.

The Canadian Domestic Engineering Co., Ltd., Montreal and Toronto, have sent us their latest catalogue on "Modern Methods of Heating, Ventilating, Sanitary and Electrical Design." The catalogue is divided into three parts, the first dealing with the organization and scope of the company, with reference to the advisability of employing a concern of this kind to carry out heating and ventilating work. The second and third parts contain brief descriptions of several installations designed by the company, also some very excellent illustrations.

George Swift & Sons, Halifax, Eng., have sent us a circular No. 30 descriptive of the line of machine tools which they manufacture. This includes, principally radial drills of various types and engine lathes which are illustrated clearly, and show distinctly the general design of the machines. Copies of this circular may be had by writing the company.

Book Reviews

The Bureau of Mines Branch, Department of the Interior, Washington, D. C., has published bulletin No. 60, entitled "Hydraulic Mine Filling." The bulletin is a report issued as one of a series, dealing with methods of increasing safety and efficiency in mining operations. It is a preliminary statement of present development in hydraulic mine filling in the anthracite region of Pennsylvania.

The Bureau of Mines, Department of the Interior, Washington, D.C., have published technical paper No. 66, entitled "Mud-laden Fluid Applied to Well Drilling." This bulletin deals with the use of mud-laden water when drilling for petroleum. The illustrations include views of different types of boreholes.

The Bureau of Mines, Department of the Interior, Washington, D.C., has published technical paper No. 58, entitled "The Action of Acid Mine Water on the Insulation of Electric Conductors." The bulletin contains reports of results obtained from the preliminary investigation into the effect of acids and moisture in mines on insulation, the purpose being to find out the best material to use for insulating purposes under those conditions. The results of tests made during the investigation are carefully tabulated and described.

"R.M.S. Aquitania" is the title of a very handsome and artistic brochure being distributed by the Cunard Steamship Co., Ltd., as a souvenir of the launching of their latest liner in April, 1913. The illustrations are exceedingly clear, and include views taken

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during various stages of construction from the laying of the keel to the launching of the vessel. The reading matter, which has been written by E. Veble Chatterton, gives much interesting information regarding the constructional features of the vessel.

Arithmetic of the Steam Boiler, by Charles J. Mason; 219 pages, 6¾ x 4¼ in.; illustrations, tables and diagrams, published by McGraw-Hill Book Co., New York. Price $1 net. This is the first edition of a work which has been included in the series of "Power Handbooks." It is a compilation of arithmetical rules and formulae, applicable to steam boilers of various types. The book deals with the application of arithmetic to steam boiler calculations, it being assumed that the reader is more or less familiar with the elements of arithmetic and understands the working of simple problems. The volume is divided into three parts. The first is sub-divided into chapters, the second is devoted to miscellaneous applications, while the third contains an appendix and a number of tables. The first chapter covers calculations on cylindrical vessels, as applied to boilers, also those for riveted joints. Boiler heads, stayed and unstayed, are dealt with in chapter 2, while chapter 3 is devoted to calculations for tubes, furnaces and boiler horse-power. In this chapter there is also an analysis of a boiler trial report. In part 2 a number of interesting calculations are given covering the strength of various parts, including formulae on safe working pressures. Part 3, or appendix, contains extracts from the rules of the United States Board of Supervising Inspectors, and from the rules of the State of Massachusetts for the design of boilers. The concluding pages contain mathematical tables, factors of evaporation, steam tables, etc. This will be found an exceedingly useful book for students and power plant engineers, and especially so for those who are preparing for examination for engineers' certificates. The author treats the subject in a practical manner, and has carefully avoided complex calculations; as a result, readers will find no difficulty in applying the data contained in the book to the solution of problems arising during the performance of their duties.

Place and Part of Snap Flask, Plate and Machine Moulding*

By A. R. Bartlett

The relative positions occupied by the above moulding systems in modern foundry practice are discussed in this article, and while it may not be said that the various details given smack of anything actually new, the different practical considerations brought under review indicate how widespread in extent and studious in application, is the foundry development movement.

MOULDING in snap-flasks is a much older practice than machine moulding, and is very extensively used in the United States, where the wooden box in all shapes and sizes is widely adopted. Snap-flasks are not of great value where heavy work has to be done, nor yet where there is not sufficient repetition work to pay for the making of pattern plates. Any light work can be made in snap-flasks, but the usual practice is not to use them for general jobbing work, though their use saves floor space for storing boxes and also the cost of supplying the usual moulding box. The life of the snap-flask is considerable, as they are always made of hard wood, and as they should never be left on the floor, but hung up after using, they are not liable to get burnt or damaged.

Snap-Flask Advantages.

In producing small castings in snap-flasks, either on the moulding machine or with plate moulding, a great deal of time and floor space is saved. Time is saved by having to handle only one pair of boxes, therefore not having to travel backwards and forwards from the stack of moulding boxes, as when ramming up in permanent boxes. The moulder rams first the bottom part, then the top part, loosens the pattern, lifts the top from the plate, then the plate from the bottom, assembles this mould, puts it in place on the pouring floor, releases the snaps, and returns with the empty boxes to repeat the operation. He has thus only to travel

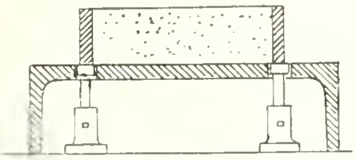

FIG. 1. PATTERN DRAWING ARRANGEMENT FOR HEAVY MOULDS.

from the pouring floor to the plate, or machine, whichever he is engaged upon, with his empty snap-flask. Time is also saved in not having to stack the empty boxes when the castings are taken from the sand. Floor space is also saved, especially where machine moulding is done, for the reason that room is not required to stack the large number of boxes wanted in the ordinary way of machine moulding.

We have done a considerable amount of snap-flask work by apprentices with plates before the present moulding machines were installed, and the number of machines having now been increased, it is found much more economical to utilize for machine moulding the pattern plates the apprentices used with the snap-flasks, by having the plates drilled for bolting to the machine table and to fit the machine box pins. However, when the machines are busy we can always fall back

FIG. 2. RAPPING PIECE.

on the snap-flasks. The pattern plates when used on the machine will have a longer life, as invariably the machines have a mechanical vibrator; if used for hand moulding, the plate gets distorted by the continual rapping and is liable to get broken by careless hammering.

The Work Feature.

Snap-flask moulding, as a general rule, must be confined to shallow work, on account of the risk of the mould bursting when poured, through having no supporting box. Deeper work can be made by banking sand against the sides and in between the closed moulds, or by placing the moulds in a trench and filling in around them. As a matter of course, all work made in snap-flasks must be weighted before pouring, and the usual way is to place a plate on the top of the closed mould, having a hole in it where the runner is located. The moulds could be clamped, but it would then be necessary to have plates on the bottom to match those on the top.

Multiple Moulding.

Multiple moulding is often done in snap-flasks, and then it is usual to clamp the work before pouring, but this work must of necessity be of a very shallow nature, and must not be very close to the outside of the mould, nor yet can it be carried very high, on account of the strain put upon the bottom mould. In placing the moulds one on the other, a plate is placed under the bottom box, a pin passing from the plate through the lug of the boxes to top plate, the top plate on the first mould acting as the plate of the second mould, and so on. The height to which the work can be carried is, of course, decided by its nature, and the heat of the metal. In some foundries it is the practice to use loose iron frames inside the snap-flask to withstand the pressure, and then, of course, the height of the multiple moulds may be increased to whatever is practical for running purposes, and heavier work can be made as well. Any light work that can be made in a two-part box can be made in the snap-flask, providing proper care is taken and the pattern plates and boxes are in good condition.

Snap-Flask Pattern Plates.

The usual method of making pattern plates for snap-flask work is to mould the patterns in a box large enough to make the plate about 1 in. larger each way than the snap-flask to be used, this extra size being to insure the moulder being able to rap the pattern plate without striking the box and loosening the mould. After the master patterns have been moulded in the correct positions to suit the snap-flask and the runners have been cut as they will be required on the plate to run the work when moulding is the snap-flask, a frame, the thickness and size of the plate required, is placed on the joint and the sand then made up round it, this forming the joint for the top to rest upon. It is the practice in some foundries to place an iron frame on the joint to form the plate, this doing away with the labor of making up the mould for the plate; but if the pattern

FIG. 3. STRIPPING PLATE FOR PIPE MOULD.

plate is made of cast-iron this is not advisable, as the edges of the plate are chilled, and are liable to get broken when loosening of the pattern takes place.

Moulding Machine Comparison.

I do not consider the snap-flask to be of any value if a machine can be installed instead, for any mould that can be made from a plate in a snap-flask can be made on a moulding machine much

*From a paper read recently before the London branch of the British Foundrymen's Association.

quicker; and, in the case of the pattern having a flat surface, even if only one or two castings are wanted off, no matter whether it is cast flat side up or down, it can be placed loose on the moulding machine table and rammed much more evenly by the press-head than by hand in the snap-flask. Also, there is always the opportunity, with a machine table with holes in it, of screwing down the pattern, thus getting the benefit of an ac-

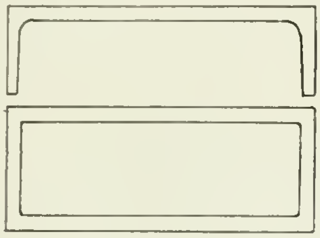

FIG. 4. SIDE ELEVATION AND PLAN OF FRAME.

curate draw; it is invariably found that the hand-drawn pattern moulded in the snap-flask leaves the mould in such a condition that patching is necessary.

Plate Moulding.

Plate moulding is the first step from general jobbing moulding to machine moulding; but it needs a greater knowledge of foundry practice than the average machine moulder possesses. It is, accordingly, necessary to have skilled labor on it in a large number of cases. It can be done with small plates as in the snap-flask, or it can be enlarged upon to a very great extent, as in the manufacture of piano frames, filter press plates of a large size, fly-wheels, etc.

Plate moulding does not lend itself to work of a deep description, as the usual method of lifting the moulding box from the pattern plate with large work is by the crane, and a good lift is not always managed by the sudden jerk of the crane,

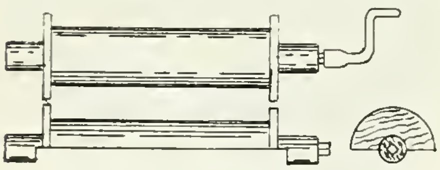

FIG. 5. PLAN, SIDE ELEVATION AND END VIEW OF PIPE PATTERN.

no matter how carefully the box is steadied off. One method employed in lifting heavy boxes off the pattern plate is to use three or four small screw jacks. These are placed on solid foundations under the plate, and a hole is made in the plate to receive the head of the jack directly under the moulding box. When the box is ready for lifting, the jacks are operated so that the box lifts steadily from the plate, and a good lift is certain if all the jacks are worked in unison. (see Fig. 1).

The usual method of vibrating the pattern is by striking a block of wood, held against the plate, with a hammer; but a great improvement on this and in the result obtained, is to bolt a bar of mild steel of the shape shown in Fig. 2 against the side of the plate and strike on the bar in the middle of the bow. This has a springing effect and saves the direct blow on the plate and the possible distortion and damage caused thereby. The size of the bar would be decided by the size of the plate and the amount of loosening necessary to insure a good lift.

In moulding a casting having both sides alike, it is only necessary to have a half-pattern, the bottom part being rammed and placed on the floor and the top part rammed and the mould closed. This method applies particularly to fly-wheels and castings similar to filter press plates. Some of the latter castings are a type of corrugated plate, having a large number of parallel ridges about a quarter of an inch high in sections, some running horizontally and some vertically across the plate. Some are studded all over with small cubes resembling hobnails. Since there is no vibration during the actual lifting of the moulding box as in machine moulding, it is absolutely necessary that a good tough facing sand be used to insure a good life, and so avoid the necessity of mending the broken parts entailed by a bad lift.

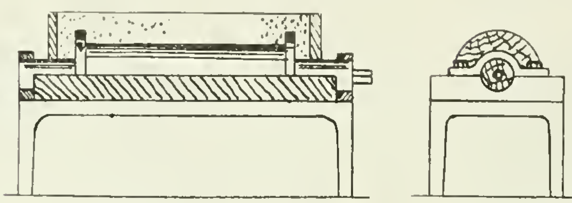

FIG. 6. SIDE AND END ELEVATIONS OF PIPE MOULDING ARRANGEMENT.

Plate Moulding Pipes.

Another type of work done on plates is the making of pipes, spindles, or any description of round casting. Any of these moulds lift clean and perfect from half-patterns fixed to a plate, and if flanges are used on them they can be worked loose and drawn out after the mould is lifted. The same applies to any lug or boss that can be dovetailed or pinned until the ramming is done, the pins being then withdrawn so that the loose pieces lift with the mould.

This idea has been improved upon by having the half-pattern made in iron and revolving in a bearing, so that when the mould is rammed and ready for lifting, the half-pattern is turned by a handle from the outside of the plate (see Figs 3 to 6). The plate itself is made as shown in Fig. 3 when for a pipe, the hole in it being the exact size of the casting required. A frame is made for the plate to stand upon, the latter being bolted on so that another can take its place when required. The frame (Fig. 4) remains stationary. The pattern itself is made as shown in Fig. 5. It is held in its place by a cap placed outside the box, and the end extending beyond the plate is made square to receive the handle.

When the mould is rammed, the pattern can be turned clear, making it impossible to get a bad lift, as there is only a flat surface to lift from, and a reasonable quantity of parting material will avoid any sticking of the sand. Only unskilled labor is employed ramming this type of work, but it is expedient to employ skilled labor to core and close the moulds. No tooling of the mould is necessary, as the turning of the polished pattern sleeks the mould, thus doing away with the moulders' tools, and saving a great amount of time.

Plate Moulding Sheaves.

Certain types of sheaves can be made on the same principle, also worms if a screw be placed in the bearing to correspond with the screw on the pattern. A practical man can adapt this method of moulding to a great number and variety of circular castings if the opportunity occur. No doubt all plate moulding could be machine moulded, and the mechanical drawing of the pattern would often save knocking out a box and ramming it up again; also, if it were rammed by power instead of by hand, a much better result would be obtained, on account of the even ramming.

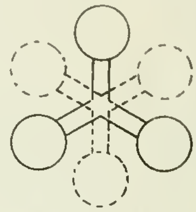

FIG. 7. MOULDING 6 CASTINGS FROM 3 PATTERNS.

It is only necessary to put half the number of patterns on a plate to the number of castings required in the mould if there be a flat back to the work and tooling is not called for on the face. They are arranged so as to clear one another when the top part is put upon the bottom (as shown in Fig. 7), half the castings being in the top and the other half being in the bottom. This will, of course, apply to any plate, whether machine moulded or otherwise.

Machine Moulding.

A few years ago the moulding machine was considered a luxury in the foundry; now it is looked upon by most metal founders as a necessity. The opposition of the skilled moulder to the moulding machine a few years ago was very keen,

but that is now passing away, for he sees that a cheap production of repetition work is relieving him of the monotony of the one job and placing larger and more intricate work in his hands than was formerly the case; for the more delicate and intricate work is not always adapted for machine moulding. There are a great number of moulding machines that demand the services of a skilled moulder to work them, as well as to follow the unskilled workman after he has rammed the work, whether by hand or power, to place the cores in position, and take the vents off in a proper manner, but the greatest economy is made on work of a simple enough character to be entirely handled and closed by the unskilled workman, i.e., the average foundry laborer.

On account of the rough usage all tools in the foundry have to stand, and the sand which is liable to get into the working parts of the machine, it is advisable to consider the durability and the simpleness of the machine before installing one. The machine that will require the services of a fitter in the event of its getting out of order will be an expensive too. In all moulding it is necessary that the moulds be hard enough to withstand the pressure of the metal and also be porous enough to let the gases generated by the hot metal escape, so as to avoid blowing and scabbing. If the right mixture of sand is used, the machine moulder can make a much better casting after he has learned to use his machine than can be produced by hand moulding.

The classes of castings that can be made on the moulding machine depend greatly on the ingenuity of the foundry foreman and his opportunity of getting the pattern-maker to make his pattern in the right way for machine moulding. The indifference of the management may limit the output of a machine, or too much enthusiasm may cause one to go beyond the bounds of possibilities, but it is safe to infer that all castings that can be made in a two-parted box can be successfully made on the moulding machine.

Machine Moulding Advantages.

Among the advantages which machine moulding has over hand moulding are greater output and greater accuracy and uniformity in shape and size. For castings that have to be machined, this latter is an important item, as the tooling is done at a regular rate, and the time and expense saved in the machine shop. Also a much better finish is given to machine-made castings. There are no heavy fins to chip off, the perfect fitting of the boxes and the perfect drawing of the pattern doing away with tooling and mending up of the mould, which in hand-moulding often causes bad joints and bad castings. Also, the cost of trimming is greatly reduced, as machine-made castings, if placed in a rattler, need no trimming whatever, only an emery wheel being needed to grind off the projecting end of a runner or riser.

There is hardly a limit to the size of work that can be made on moulding machines. Very small work can be most successfully done, also large work on machines made for that purpose. Of course, all boxes and patterns must be accurate and must be kept in a state of perfect efficiency to ensure good results continually.

Installing a Suitable Machine.

Before purchasing a moulding machine it is necessary to consider what type of machine is best adapted for the work to be done. It must not be thought that any machine will do any and every job. Also, it is impossible to run a general foundry with moulding machines only. In selecting a machine it is necessary to consider how many different castings can be made on any one machine, and then consider what would be the cost of working the machine, and whether any excess of power that is running to waste in the shape of compressed air or hydraulic power could be utilized for operating it.

The adoption of machine moulding has caused great changes, not only in moulding, but in pattern-making also; for with the patterns for machine moulding being made of metal or hard wood, and not getting broken with the rammer, and with the equal ramming given by the press-head or the jar rammer, the need of venting done away with to a large extent, the patterns do not get broken or spoilt with the vent wire; and the loosening bar not having to be used or holes made in the pattern for drawing, the damage to patterns is much less.

Where possible, it is advisable to ram bottom parts and top parts alternately, for in so doing the moulds can be closed at once, and if cores are to be placed in position they invariably go to the bottom part. This often saves the need of cleaning the moulds of dust and loose sand that will find its way into an open mould, and the necessary mending if anything should fall into it while waiting for the top parts.

Drawing of Patterns.

The drawing of patterns from the mould differs in the various types of machines, some lifting or lowering the mould from the pattern plate which remains fixed to the machine, and some drawing the pattern, while the mould remains stationary as in hand moulding. With machine-drawn patterns it is not so needful to have as much taper as would be necessary with the same pattern if hand-moulded, but if the pattern be undercut, no amount of vibration will insure a good draw on the machine; so it follows that all patterns for machine work must be properly made. An undercut pattern can be made to do if hand moulded, but at the expense of severe loosening and consequent damage. Every type of machine has its adherents. One man will advocate the turnover machine; another will not see the necessity for the turnover. This is to a very great extent dependent on what class of work is required. For shallow work the non-turnover machine is the most economical, as it saves the operation of turning, which operation, of course, takes time, and if not necessary should not be done, even if the work be rammed on a turnover machine.

With the turnover machine the more intricate work can be lowered from the pattern in a perfect condition. Work having deep internal parts, such as pulleys or boxes, are turned out much better from a turnover machine than from a non-turnover machine. With the turnover machine the mould is in the right position for placing on the floor as regards the bottom part, and this often saves irons or gaggers in deep work, as there is no fear of the deep parts falling off, which is likely to happen in the non-turnover if no gaggers are used. As regards the top parts, it is essential that the same work should be done on both machines on deep work, as in both instances the deep or hanging part has to be made secure to prevent falling off when placing the top part on the bottom.

For deep work the jar-ramming machine is undoubtedly the best, as there is no need to hand-ram any part, as would have to be done on a press-head machine. With the jar-rammer the ramming is hardest where it is most essential that the mould should be sound to withstand the strain of the metal and also on the joint. The mould is also rammed evenly, whereas if a hand rammer be used to ram round the deep parts of the pattern, the latter is always liable to get hit and damaged.

Stripping Plate Type.

The machine fitted with a stripping plate is a very useful type for large pulleys or tooth wheels having straight teeth. The pattern is drawn down, or up through the plate, which supports the sand on the edge of the mould, thus insuring a perfect lift or draw when the mould is taken from the machine. This, no doubt, is an expensive machine, as every size of wheel must have its own stripping plate. Knowing how difficult it is to get a perfect draw by hand when moulding a spur-wheel pattern, and how slowly a badly-drawn mould is mended, it is obvious that a machine for this work is very economical if there be suf-

ficient work to justify the outlay necessary.

The different machines on the market are so varied that every metal founder has the opportunity of getting a machine best adapted to his requirements with very little trouble. There is the wheel-moulding machine for those who are making a quantity of spur wheels, no matter what type of tooth is required, whether for helical, straight, or flanged wheels, and up to almost any size. On this machine great care has to be taken in fixing the diameters, and experience is necessary to insure a good result. There are also many types of hand-power press-head machines for small repetition work, giving rapid and economical production; also the hand-ramming machine for deeper work, which can be operated by unskilled labor after a very little tuition.

The Ramming Feature.

At first sight it does not appear that much saving of time can be effected on a hand-ramming machine, but when consideration is given to the fact that the patterns are drawn perfectly true and that the mould does not need patching and tooling, as in the usual jobbing moulding, then it is realized what a great economy is effected on the machine from this aspect only. The remark is often made that a hand-ramming moulding machine is only half a machine; but four or five times the amount of work can be turned out per day than a skilled moulder will do, and the credit must be due to the perfect drawing of the pattern and the saving of time effected thereby. These machines are in great demand where no power is available, and are often more economical to small founders if they can do the work required, as the cost of installing compressed-air or hydraulic power is a big item.

With compressed air or hydraulic power installed, a much greater variety of work can be done, especially where the head of the machine can be altered to suit the depth of the boxes to be rammed. Not only can perfect ramming be done by the power machine, but the vibrating or loosening of the pattern can be done in a most regular and efficient manner, and with the knowledge gained in using the vibrator it becomes common practice to give just sufficient vibration to insure a good draw. Too much vibration is liable to cause the work to fall out when lifted from the machine.

With power machines of this type, it always follows that the sand is rammed hardest close to the pattern and the box, on account of the resistance offered by them, leaving the sand between these two points in a more open condition, thus helping to vent the mould and leaving an open passage for the gases to escape. This avoids the necessity of the venting which would have to be done on hand-rammed work, where the hardest ramming is usually in between the pattern and the box.

Deep Work Machine.

A machine that will do deep work very effectively is the combined jolt-ramming and press-head turn-over machine. The moulds made on this are mainly rammed by jolting, the press head being used to ram the loose sand left on top of the box after jolt ramming. The machine is rapid, and is adaptable to shallow as well as deep work, the number of jolts needful to ram each job being decided by what strain is put on the work when pouring and the weight of the casting required, shallow work requiring less jolting than deep work. The method of working this machine is to fill the box with sand, placing any irons in position, no matter what depth the box may be, give it the required number of jolts, bring the press-head down on top of the loose sand, then strike off the superfluous sand. The box is clamped to the turnover table, which is then turned by power and lowered to the drawing-off plate. Attached to this plate are 4 iron wedges, which are put into position under the box all together by means of a lever, thus insuring the box being parallel to the pattern plate when drawn.

Jolt-ramming machines are greatly in use for large and deep moulds, the machines doing ramming only; but a large amount of time is saved, very large work being rammed in a few minutes which, by the usual method of hand-ramming, would take two men a day or more. As with the small, combined machine before mentioned, the sand and necessary irons, grids, or gaggers are placed in position; the jolt table is then operated by opening a valve, and when the required number of blows have been given the valve is closed and the top of the sand flat-rammed by hand.

It is not necessary to fix the pattern plate to the jolt table, but it must be so placed above it that the weight of the work to be rammed must be evenly balanced. The pattern plate is usually a flat one, the ordinary wooden pattern being placed in the necessary position on it to suit the box, then the box is clamped or bolted to it. When rammed they are lifted off and turned over. The pattern is then drawn by hand and the mould finished in the usual way. The pattern must be flat next to the plate, this necessitating it being made in two when it is not a flat job. Some machines of this type have a pattern-drawing mechanism attached.

Large cores are sometimes rammed on the jolt machine, and then turned out in the ordinary way. All patterns for this type of machine should have no overhanging parts, as the sand would be held up by them. Any side extensions of the pattern that do not touch the pattern plate, or would want a drawback or sloping joint to get them out in the ordinary way of moulding, must be printed and cores made to form the desired shape. All work rammed on the jolt machine is so evenly rammed that the vent wire is very seldom used. The machines are of various sizes and power, some giving a 3 in. and some a 3 ft. jolt, working at a capacity of about 80 lbs. The tables on them range from about 15 in. square to about 8 ft. by 12 ft. or thereabouts. The pattern plates can extend beyond the table if they are made rigid enough to take the weight of the mould and the blow given. The small size mentioned will ram a weight of about 300 lbs.; the larger they are made the more weight they will ram, the mechanism being made in proportion.

Buying Coal on a Systematic and Scientific Basis

By Hugh Lamont

Concurrent with other steps being taken to improve and keep in the forefront, steam as the motive power in our manufacturing and general industrial enterprises, the question of a suitable and uniform quality supply of fuel in the shape of coal is receiving closer attention. In this article are indicated various considerations which contribute to make a careful study highly profitable to the consumer.

THE generation of electrical energy from our waterfalls, and its distribution at cost, through our provincial and municipal governments, has done much to popularize the utilization of electric power in various manufactures, where steam had heretofore been the source of energy. Not a few instances of the discarded steam boiler has been the result, and where the steam boiler has not been discarded, there has been a general "toning up of the system," as it were, resulting in the adoption of the latest and best appliances for in-

creasing the efficiency of the boiler. In other words, the manufacturer who depends on steam for his power has been and is endeavoring to utilize to its fullest extent the heat units stored in his fuel, which is usually coal. In this he has been ably seconded by the fuel engineer, the manufacturer of boilers, the manufacturer of stokers; in fact, by the manufacturer of all kinds of accessories that have for their aim the minimization of losses in the generation and transformation of energy.

Everything that is being done is done with a view to the elimination of losses in the power plant; but the loss annually occurring through unbusinesslike methods of buying coal is one to which the average consumer of this country has given little thought. Practically everything the manufacturer buys is bought under a guarantee of some kind; but when it comes to buying coal, he still continues to buy on the basis of its looks or its general reputation, though it is a self-evident fact that, in order to get the highest efficiency in the power plant, it is first necessary to have efficient methods for the selection and purchase of our source of energy, namely—coal.

Constituents of Coal.

A proximate analysis tells us that coal consists of moisture, volatile matter, fixed carbon, ash and sulphur, and, according to the proportions of these component parts, we have coal varying from the highest grade anthracites through the different grades of semi-anthracite, semi-bituminous, bituminous, down to the lignites.

Moisture in coal is partly due to the moisture existing in the coal as mined, and is partly due to conditions of the weather during transit. At any rate, it has no heating value; but it is there in all coals, and in percentages over which the shipper has no control.

Volatile matter consists of carbon, hydrogen, oxygen, and nitrogen in varying percentages, and is given off as gases during the first stages of combustion. As some of these gases are inert, the heating value of the volatile matter is a variable quantity.

Fixed carbon is the chief source of energy in coal, as the process of combustion consists mainly in the burning of this carbon, together with the carbon and hydrogen of the volatile matter, and with the oxygen of the air introduced through the draft.

Ash is the residue left after all the combustible matter has been burned out of the coal, and consists of silicia, alumina, iron oxide and sulphide, sulphate of lime, magnesia, etc. Coals having ash high in sulphide of iron and fusible alkalies have a tendency to form a slag, which often adheres strongly to the grates, thus seriously interfering with the draft, and are more to be feared on this account than a coal where the ash is high in silica and alumina. Coals having a high percentage of ash are, as a rule, more difficult of combustion under ordinary conditions, than the lower ash coals.

Sulphur exists in coal as iron pyrites, sulphate of lime and as free sulphur. Free sulphur burns readily and has a heating value, though disagreeable odor, but, where found in combination with iron and lime, its tendency is to form a slag as noted above.

Calorimetric Test.

From the foregoing we have a knowledge of the component parts of coal as represented by a proximate analysis, but on account of the variable factor introduced by the volatile matter, an analysis of this description does not always represent the relative heating values of different coals tested in this way. As the heating value of a coal really represents the available energy stored therein, it follows that a comparison of different coals should really be made on a basis of their heating values. This can only be done by a calorimetric test, which consists in burning a weighed portion of the coal in a metallic bomb immersed in a measured quantity of water, and noting the rise in temperature of the water due to the combustion of the coal. The heating value of the coal, thus determined, is expressed as so many British thermal units, (B.t.u.) per pound of coal. By comparing the heating values found by calorimetric tests on various coals with the results of proximate analysis, we often find that coals, of apparently the same analysis, will vary considerably in heat units. This variation is due, as noted before, to the volatile matter.

In the selection of a coal, the consumer has also to take into consideration the adaptability of the coal to his furnace conditions. To determine this factor tests for furnace efficiency should be conducted under actual working conditions. The number of pounds of ashes removed for every hundred pounds of coal fired, taken in conjunction with the percentage of ash as determined by laboratory tests, will give a basis for comparison of the relative adaptability of coals thus tested. For instance: suppose a certain coal shows by laboratory tests ash of 10% value, which would mean that 90% was combustible matter; and that, from the fires, there was removed 25 pounds of ashes for every 100 pounds of coal fired. It would show that instead of burning 90% of the coal, we are actually only burning 75%, and 15% of the combustible matter is carted away in the ash and clinker. It follows that the nearer we approach the 100% mark on these tests the more adaptable the coal is to furnace conditions. In actual practice, an approach within three per cent. is considered good.

Specification Covering Supply.

Having determined by test the kind of coal that may be burned successfully in any given plant, it is important to the consumer that this standard of coal be delivered at all times, and specifications covering same should be made part of the contract under which he buys his year's supply. It is important also that the specifications be so drawn that it will be to the interest of the dealer to carry out his part of the transaction. In specifying the heating value of coal as a basis of a guarantee, the contract should be so drawn that all coal deliveries are paid for on the actual heat units contained in the dry coal. This automatic system of regulating penalties and bonuses is arranged for by specifying in the contract, the net B.T.U. to be delivered for one cent, thus:—

Suppose the contract calls for coal containing 14,000 B.t.u. per pound, at a price per ton of \$1.90. This means that for every ton of coal delivered, the consumer is to receive 28,000,000 B.t.u. (14,000 $\times$ 2,000), for which he agrees to pay \$1.90, or, for every cent expended, he is to receive 147,368 B.t.u. (28,000,000 $\div$ 190c.). This then is the basis of the contract and all coal delivered thereunder should be carefully sampled and the B.t.u. value determined by calorimetric test, and all coal represented by each sample should be paid for in accordance with the heating value found.

For instance, suppose a sample represents 100 tons of coal, guaranteed as above. Actual tests, however, show that the coal contains but 13,800 B.t.u. per pound, or (13,800 $\times$ 2,000), 27,600,000 B.t.u. per ton. As the contract calls for 147,368 B.t.u. for one cent, the 100 ton unit, as mentioned above, is worth only (27,600,000 $\div$ 147,368), 187 cents, or \$1.87 per ton, the price which should be paid. Suppose, on the other hand, however, that the coal delivered shows by test a value of 14,200 B.t.u. per pound or (14,200 $\times$ 2,000), 28,400,000 B.t.u. per ton, then, as the dealer only agrees to deliver 147,368 B.t.u. for one cent, the value of each ton in this case becomes (28,400,000 $\div$ 147,368), 193 cents or \$1.93, the settling price.

It has been pointed out that, with one exception, the heating value of a coal represents its money value. The exception is in the ash. The higher the ash, the more difficult it is to burn out the combustible matter, and the reduction in price, in accordance with the calorimetric test, does not make up to the con-

sumer the loss in furnace efficiency and added expense for removal of excessive ash content. It follows then, that there should be a limit placed on the per cent. of ash allowable, and some provision made for the rejection of coals exceeding this limit, or for acceptance at a reduction in price greater than that due to the B.t.u. This precaution is necessary to prevent the substitution of inferior grades where it has been demonstrated that a high grade coal is an absolute necessity in obtaining good furnace efficiency.

The consumer will likely find a reluctance on the part of the coal dealer toward a guarantee as specified herein, but, when thoroughly understood, a contract of this kind is eminently fair to both. It protects the dealer who is prepared to furnish high grade coal in competition with dealers handling inferior coals at the same price. It encourages him to deliver coal above contract grades by providing a premium for all coal thus delivered, and, on the other hand, the consumer will find it to his advantage to pay a premium of the extra heating value delivered.

This plan has proven successful in many localities, and will prove itself satisfactory wherever the specifications are carefully drawn, and the consumer and dealer alike, have a knowledge of the basic principles that tend to make for efficiency in the coal pile.

G.T.R. STRATFORD APPRENTICES' BANQUET.

THE apprentices of the G.T.R. shops, Stratford, Ont., held their ninth Annual Banquet on the evening of March 23rd in the G.T.R. Assembly Hall there, which was tastefully decorated by the Ladies' Auxiliary of the band. About 200 apprentices and guests were present, including delegations from the shops at Battle Creek, Mich., Montreal, Toronto and Ottawa. Mr. Robert Patterson, master mechanic, made a very able chairman, and he had on either side several prominent officials of the G.T.R. System, including H. G. Kelley, vice-president; W. D. Robb, Supt. motive power; J. H. Guess, general purchasing agent, and J. M. Markey, master mechanic, Toronto shops, while other prominent guests included Mayor Stevenson, of Stratford, M. C. McLeod, president of the Board of Trade, Stratford; Dr. Silcox, principal of Stratford Normal School, and C. A. Mayberry, principal of Stratford Collegiate Institute. Representatives of the Stratford "Beacon" and "Canadian Machinery" publications were also present. The G.T.R. band was in attendance and played several selections during the banquet, after which there were vocal and instrumental selections, and recitations between the speeches; all numbers being encored with great enthusiasm by the apprentices.

The chairman opened the proceedings with an interesting address on the "Work Done by Apprentices," remarking that very satisfactory results were being obtained, and that a high standard was being achieved. Mayor Stevenson and Mr. McLeod referred to the progress being made by the city of Stratford.

PROGRAMME.

Chairman's Address ....
Mr. R. Patterson, Master Mechanic.
Toast—The King ....
God Save the King.
Toast—Our City ....
Mayor Stevenson.
A. C. McLeod, Pres. Board of Trade.
Quartet—Selected ....
Messrs. Barnsdale, Choyce, Wilkinson and McLean.
Toast—Grand Trunk Railway System..
Mr. H. G. Kelley, Vice-President.
Song—True Till Death ....(Gatty)
Mr. C. Kelso.
Toast—Motor Power Department.......
Mr. W. D. Robb, Supt. Motive Power.
Recitation—The Little Hero ....
Miss Helen Mar Patterson.
Toast—Our Ex-Apprentices ....
Mr. Bruce Dunlop and Donald Ross.
Instrumental Duet—The Elks' Parade.. ....(C. W. Poe)
Apprentice W. Plummer and J. Millman
Toast—Our Apprentices ....
H. Colombo and F. McInnes.
Song—Selected ....
Apprentice E. Davis.
Toast—Our Visiting Apprentices ......
Apprentices from Montreal, Battle Creek and Ottawa.
Recitation—Selected ....
Miss Helen Mar Patterson.
Toast—Our Educational System ....
Dr. Silcox.
Instrumental Solo ....
Apprentice H. Schultz.
Toast—Industrial Training ....
C. A. Mayberry.
Song—The Mighty Deep ....
Mr. J. Wilkinson.
Mr. J. Bottomley ....Accompanist
Caterers..Ladies' Auxiliary of the Band
Music .................G.T.R. Orchestra

Mr. H. G. Kelley, in responding to the toast of the "G.T.R. System," in a thoughtful address, outlined the history of the road, remarking that the apprentices might profit by the good work done and example set by the engineers who located and built the road, which the speaker said was a work that could hardly be improved upon. Mr. Kelley gave some helpful advice to the apprentices and dwelt at length on the value of technical training.

Mr. W. D. Robb in responding to the toast of the "Motive Power Department," said that he had been in the service of the company 43 years and proceeded to review some of the changes which had taken place in that department during these years. Mr. Robb also gave some interesting information regarding the development of locomotives, showing how they had increased in size and also in cost since his appointment to the present position in 1901.

The toast, "Our Ex-Apprentices," was responded to by Messrs. B. Dunlop and D. Ross, while the reply to "Our Apprentices" was undertaken by Messrs. H. Colombo and F. McInnis. "Our Visiting Apprentices" was handled in an able manner by Messrs. —. Boast, Montreal; G. Patrick, Ottawa; W. Browning, Toronto, and C. Kapenke, Battle Creek, Mich.

Dr. Silcox made some interesting remarks on educational systems, touching briefly on technical education in Denmark and Switzerland, and emphasizing the value of the G.T.R. apprentice system. Mr. C. A. Mayberry gave an address on Industrial Training.

The banquet was conceded by all as being a great success, and reflected great credit on the apprentices who paid for and carried out the entire arrangements. A pleasing feature was the enthusiasm and esprit-de-corps shown by the present and past apprentices and their recognition of the efforts which are being made by the motive power officials, especially by Mr. Patterson, to help them in their work. The proceedings terminated at midnight by singing of the National Anthem.

Cooling Electric Generators.—In an article which appeared in the General Electric Review recently, on "Ventilation of Steam Turbine Engine Rooms," attention is first called to the increasing amount of power that is being put into engine-rooms per cubic foot and per square foot of floor area, thus rendering the cooling of the generators a more difficult problem, apart from the fact that high-speed generators are of smaller dimensions per kilowatt. The design of air ducts is considered for conveying cooling air to the generators, and formulæ are given for this purpose. It is shown that the amount of heat that can be absorbed by saturated air is only very little above that which can be absorbed by dry air; consequently, not much is to be gained, from this point of view, by the use of spray filters. On the other hand, the temperature of the air is lowered much more by apparatus of this kind than is practicable by other means. Curves are given showing the size of spray filter that is necessary, and figures are given showing the gain by the use of such plant under various climatic conditions. A brief reference is made to the possibility of using the heated air from the generators for supplying the necessary draught for the boilers.

The Psychology of Rest Relative to Modern Business Life

By George Sherwood Hodgins*

A poor attempt at recuperation is made by the man who looks on his out-of-business time as so much loss, and who thereby causes it to be a period of dull routine. The present-day tendency is almost wholly towards the above-mentioned state of being, and finds exemplification in our business enterprises all the way from centre to circumference of their personnel and organization.

I ASKED a busy man why he did not take more time to rest, and he misunderstood me. He confused rest with lack of activity. I explained that I had not suggested that he should do nothing, but simply that he should change the form of his activity. He replied with the least touch of superiority in his tone: "My dear fellow, do you suppose a passenger car on the Pennsylvania Railroad, constantly traveling between New York and Pittsburgh, would hope for rest if it should be run on the New York Central between here and Albany?" and he triumphantly added, "That would be complete change of activity and change of scene also."

I pointed out that the car, when on the New York Central, would run upon a track having the same gauge as that of the Pennsylvania Railroad; that the wheels would revolve just the same on both lines; that their motion would be arrested by the same brake, and the whole running gear would be subjected to similar conditions on either railroad. But I also made it clear, that if the car had been structurally adapted for railway service and was also capable of floating in water, and had been towed up the Hudson River to Albany, and, moreover, if it had a brain capable of being tired or refreshed, then the change would be highly beneficial—to its brain.

The Human Brain.

The human brain is always active, and it is impossible for a man to stop thinking, though it is possible for him to direct his thoughts. In sleep the brain is less active, but consciousness, in the strict sense of the term, never departs. A person accustomed to the quiet of the country at night may not be able to sleep in a large city hotel. He is constantly awakened by what are to him the unusual noises of the street. . There is the clang of the overworked street car gong, and the cry of the newsboy with the so-called "extra." There is the melancholy whistle of the river boats and the tolling of bells for the hour, as if everybody did not carry a watch. On the second night he fares better, and thinks he rested well because he was tired after his first night. He misses the fact that the alert brain, which at first kept the mind active, finding later that the noises do not mean danger, did not, on the second night, arouse the sleeping limbs.

The brain is normally rested by sleep, the directing will is temporarily withdrawn, the body is relaxed and the darkness and comparative stillness reduce the number of external impressions received. The rebuilding of brain tissue is greatest and the strain caused by cerebral activities is reduced to a minimum. The brain is a wonderful development of bodily structure. Science tells us that the brain of a fish is very small compared with its spinal cord and with the nerves which branch out from the cord. In reptiles the mass of the brain compared with the spinal cord is greater than in fishes. The brains of birds show an advance over those of reptiles. The lowest mammals exhibit a superiority in this direction over birds, the higher mamalia are a step above, and the series culminates in man.

All through these gradations the increase in proportion of brain to spinal cord has been paralleled by the increased development of the sense organs. The brain appears to have had its origin in nature's endeavor to provide the necessary and highly complex terminals for the reception of sense impressions. The nerves of sight, hearing, smell, taste and touch respectively reach in the brain corresponding masses of specialized nerve cells, responsive only to the appropriate call of each. Modern science has succeeded in locating certain brain regions as being the seats of certain sensations, and the governing centres for the movements of particular limbs. A severe blow on the left temple will deprive a person for a time of speech. Another tract has to do with the movement of a hand, another with a foot and so on.

Reflex Action.

Many actions are involuntary, such as the closing of the eyelid at the sudden approach of some object. Here the ingoing stimulus reaches the brain and is "reflected" into an outgoing stimulus which reaches and acts on the muscles of the eyelid. The act of closing the eyelid is performed without the impulse producing in the brain any consciousness of the process. This action is said to be "reflex," and all constantly repeated actions tend to become reflex. Nearly everyone has noticed when walking on the street that it is actually easier to pass over a longer distance in going around behind a slowly moving vehicle, thus maintaining one's speed, than it is to stop and wait for the vehicle to go by. Stopping and waiting would have been a conscious act. This is a bit of nature's economy. The fatigue caused by a reflex act is less than from a conscious one.

Example of Reflex Action.

Huxley gives an interesting example of reflex action pure and simple, in which the spinal cord is concerned. A frog was decapitated and placed on the table. It was, of course, incapable of volition. When a drop of vinegar was placed on the top of one thigh, the foot was drawn up and a distinct effort was made to rub off the irritating acid. When ths leg was held, the other foot endeavored to rub off the vinegar.

We often speak of a thing happening "as quick as thought." The rate at which nerve impulses travel vary from sixty up to perhaps ninety feet a second. In man the time occupied for a reflex action is negligible, but if the Statue of Liberty in New York Harbor came to life and was bitten on the foot by a mosquito equal to the task, the nerve impulse traveling at the speed of an express train would require about two seconds to reach the head. The return impulse, taking the same time, would allow the mosquito (perhaps the size of a puppy dog) about four seconds ere the goddess would move her ponderous foot and shake the insect off.

Some scientific men, studying the many strange reflex actions of which we are capable, and having regard to sense impressions, have called us "conscious automata." They say a dog seeing a rabbit has his brain stimulated by the optic nerves, and that the brain in turn stimulates the muscles of his legs, and pursuit of the rabbit results. They say the dog did not hunt for the rabbit in the first place, but seeing it he automatically pursued it, because the once conscious act of his ancestors has become a reflex action to him. The fact that "reflexes" sometimes look like conscious efforts of the will, may explain many of our so-called impulsive acts. Shakespeare says in King John. "How

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oft the sight of means to do ill deeds, makes ill deeds done."

The investigations and theories outlined above prove that man is after all a very complicated piece of mechanism and needs care and special attention like any other piece of delicately-constructed machinery. Arnold Bennett truly says: "In case of friction, the machine is always at fault."

Sameness Tends to Brain Fatigue.

Character is the sum of our habits, and they are formed for the most part unconsciously by daily repetitions and without definite plan. Doing what we dislike, the talk of a bore and the effect of "things going wrong" produce a mental state which, when it reaches the point of fatigue, produces a poison which alters the constitution of the blood. The constant recurrence of identical stimuli, i.e., the same thing over and over again, invites a form of fatigue, as when one is constantly associated with an unpleasant personality in the office or elsewhere. All this does not produce any serious result in the brain of the average man provided he has sufficient recuperative powers. In some it produces irritability, and irritability is a bad brick in the foundation of character. Mirth and humor are the antidotes for irritability. It is probable that the popularity of comic opera and the buffoonery of the vaudeville stage are commercial attempts to supply, artifically, what habitual good humor would do of itself. The proper view to take of those we meet in daily life is to regard them as the raw material out of which we must make a happy day for ourselves, not by walking over them, but by mingling with them on friendly terms.

A Dangerous Zone.

When we come to sheer hard work with the brain, we are close to the danger zone for many a business man or factory head. Attention to one thing or one line of thought is a strain very like excitement so far as the effects are concerned. It takes more blood to supply a hard-worked brain than it does for the same brain when it is tranquil. An excited man finds that his temples throb. More blood is needed because the waste of tissue is greater. Nature here endeavors to introduce a sort of economy. Close attention causes many external impressions to be shut out from the consciousness. The process of shutting out external impressions assists in maintaining attention, but while it helps the worker for a time, it has its effect on the brain. Cats, both large and small, which lie in wait for their prey develop such concentration of attention as practically to deaden the other faculties. When in this state hunters can usually approach them without being perceived. A man may work hard amid noise and disorder, but in time fatigue appears as nature's protest against the strain of work, the noise and the distractions caused by the disorder, and the attention automatically slackens.

A poor attempt at recuperation is made by the man who looks on his out-of-office time as so much loss and who causes it to be a period of dull routine. Such a man is like one who laboriously applies a highly-tempered tool to the muddy surface of a water-soaked grindstone. The real recreation, or re-creation as the word is, may be had by him who enjoys the happy home circle with its wholesome non-business atmosphere. The wordy war of wit among congenial friends will strike his cares and worries off in scintillating flashes as a spinning emery disc strikes glowing sparks from a surface of dulled steel.

Examples of Overworked Brain.

An illustration of breakdown from an overworked brain is given by Prof. Mosso, an Italian psychologist. A dozen men in apparently good health, if exposed to the weather for some hours on a very cold night, will give evidence of the physical strain in different ways. One will have a cold, another a sore throat, another will develop pneumonia, still another will have intestinal disorder, while others will not be seriously affected. The exposure to cold found the weak points of those it touched and disease entered through the unguarded gate. Apparently normal men differ widely in temperament, and temperament depends principally on the nervous system. If the nervous system is run down, the cumulative effects of constant small overstrains with insufficient recuperation, are like the oft-repeated stresses in a bar of steel, each below the elastic limit, yet they produce in time, if no remedial or heat treatment intervenes, the slow creeping "facture in detail" and the final, sudden snap.

Brain Power Stocktaking Essential.

The man most concerned does not realize what he is doing when he overworks his brain, and so it happens that very little care is taken of the real "working power" of the great business enterprise. Friends may see it, but the brain of the tired man works on, oblivious of its own condition. It is wisdom for each man to stop and "take stock" of his powers. In nine cases out of ten the man who breaks down does not expect it. It is this "skating on thin ice" by a man who has no idea of his mental whereabouts, which causes his partners or business associates to insure his life, and pay the premiums themselves. This they do as a safeguard for their own interests, so that when the "business head" of the organization or the "brains" of the enterprise shall collapse, they will not be left without the results of his concentrated and forced effort to do the work, the whole work and nothing but the work, every day, all day, and many times at night.

Distraction Helpful.

"If you want something done, go to a busy man," so runs the proverb. But the busy man who can help you is he who is willing to use, to his own mental advantage, the wholesome distractions that daily

A MODERN PICTURE.

THE average business man will perfect every detail in his factory. He will supervise his organization, cheapen production, introduce safety appliances, look to his fire protection, revise business methods, secure new contracts, listen to shopmen's grievances, facilitate the handling of material, market his product, advertise his wares, direct expenditure, point out economies, keep efficiency before the working force—and yet he will not take ordinary common-sense care of the "guiding principle" of the whole thing. He would make more fuss if the roof leaked, than if he felt his head swim at his work. It is impossible to put in accurate per centage the difference in time and mental force, which he expends on his work and on the care of himself. It is, however, an extremely conservative estimate to say that the care of himself stands in proportion to his work, far less than the duration of a lightning flash does to the time occupied in the passage of a heavy and prolonged thunderstorm. If an outsider from the planet Mars saw only this man's actions, the visitor might declare that the man's evident desire was to build a machine to make money and to put himself under the sod as quickly as possible.

life affords. Prof. Mosso tells us that most people take 134 thousandths of a second before responding with the hand to a touch on the foot. Fatigue of attention increased the time to 200 or 250 thousandths of a second, an increase of 49 and of 86 per cent. respectively. A steady worker thinks more slowly as time goes on. This is the cost of being tired.

As yet science does not attempt to measure the value of cerebral effort. It may be physiologically the same to think out a money-making act as it is seriously to consider the appropriate filling of the children's stockings at Christmas. The result in the one case may be dollars and cents, and in the other your own satisfaction and a group of happy youngsters. The real value to you lies in the change of thought it produces, and your mental health is evidenced by your willingness and your ability to change. Look out for yourself when you only want to do one thing; it's a sign of old age that you do not need to have. Everybody admires a fine automatic turret lathe, and the cause of the admiration is that it can perform more than one operation, cleanly, expeditiously and with vigor. Your range is almost infinite compared to the best turret lathe ever made. The human mind, healthy and alert, travels on no particular set of rails. Its ability to change from one thing to another and to gain rest by the change, is at once its marvelous faculty and its salvation.

Use of the Business Head.

The danger of brain-fag is peculiarly ours. Prof. G. M. Beard, the noted American neurologist, was convinced that in no other country is nervous exhaustion so common as in the United States, and that no other country exhibits so many varieties and symptoms of nervous debility. Prof. Mosso believes that among politicians and business men the effects of overstrain are most marked. The remedy is simple enough, and it is constantly given by friends to one another at the moment of parting. "Well, good-bye, old man, take care of yourself." But the reply, "Yes, yes," is meaningless, and the self-constituted drudge goes back to his limited horizon bounded only by his work.

This man will perfect every detail in his factory. He will supervise his organization, cheapen production, introduce safety appliances, look to his fire protection, revise business methods, secure new contracts, listen to shopmen's grievances, facilitate the handling of material, market his product, advertise his wares, direct expenditure, point out economies, keep efficiency before the working force—and yet he will not take ordinary common-sense care of the "guiding principle" of the whole thing. He would make more fuss if the roof leaked than if he felt his head swim at his work. It is impossible to put in accurate percentage the difference in time and mental force which he expends on his work and on the care of himself. It is, however, an extremely conservative estimate to say that the care of himself stands in proportion to his work, far less than the duration of a lightning flash does to the time occupied in the passage of a heavy and prolonged thunderstorm. If an outsider from the planet Mars saw only this man's actions, the visitor might declare that the man's evident desire was to build a machine to make money and to put himself under the sod as quickly as possible.

Remedy Easy—Medicine Pleasant.

The remedy is easy and the medicine pleasant to take. You can best mind your business when you make a business of your mind. Did you ever stop to think what an ocean of pleasure and interest lies stretched out beyond your narrow shore? As a healthy change, you can read history and mark the slow but sure advance of personal liberty. You can play golf, tennis, polo or what you will. You can be the home carpenter and man-about-the-house. You can study physics and discover enchantments in the commonplace things of life. You can roam unhindered in that fairyland of science, astronomy, and on a starlit night you can pick out the constellations as they "burn in the velvet blue." If you are observant go into the woods and look with new interest on the flowers and the trees. A few summers ago, you might have seen the cicades, after seventeen years of grub life in the earth, turn into winged locusts for about three weeks and die. You can compare their life's effort with your own, and it may be worth while.

Whether you read, or play, or work, or search, or observe, you must give up the steady, killing grind. Enjoy yourself in many different ways, for what shall a man give in exchange for his life?

DESIGNING FOR REPETITION WORK.

By A. Whitehead.

PRACTICALLY all designing falls in between two extreme classes:—

1.—Designing with a view to insuring the utmost efficiency with little regard to first cost.

2.—Designing without regard to efficiency, the aim being to produce at such a low price as to command a certain sale.

In most cases a machine of stated capacity must be sold at a price which is fixed principally by conditions outside the control of the makers. Only when a firm has a monopoly by reason of patent rights, or of attainment superior to that of its competitors, can price be independently fixed at the firm's own discretion to suit their particular designs and workshop practice.

Nor is price fixed solely by external factors. Fashion (perhaps that is rather a harsh word) plays a great part in settling many features of design, so that, to a very large extent, the average designer is restricted to inventing mere minor variations from the standard furnished by previous experience, wedded to the prevalent fashion. Thus, the common task of the designer is to make these minor variations tend towards increased efficiency and economy, so far as his skill and knowledge enable him. In order to prepare a successful design, it is necessary to have a good knowledge of—

1.—The essential features and properties which the contemplated machine must possess.

2.—The best way to obtain the desired results by mechanical means feasible with the available plant—that is to say, it is necessary also to know:

3.—The resources of the available plant.

Designer's Shortcomings.

Information respecting the first in order may be collected by someone in touch with customers and the work of rivals, and imparted to the designer to supplement his gleanings from sources accessible to him. He is usually suitably placed to find out whatever he wishes to know in connection with the third point; but, unfortunately, a designer thinks in forms—cylinders, cones, and so on—simply combined in the ways which he has been trained to believe the only possible ones for economical production. Musical composition affords an excellent parallel. The composer thinks in harmonic combinations, which he is trained to believe are the only acceptable ones; but the great composer, with superior mastery of technique, will never hesitate to violate accepted canons if, by so doing, he can obtain the effect he seeks. Lesser men attain far less success with far more commotion.

The composer whose highest experience had been confined to compositions suited to the capacity of two trumpets and a drum would not readily grasp the possibilities of a full orchestra, except in point of the volume of noise. In a similar way the average designer often fails to perceive what may be done with a modern plant. His lack of technique does not allow him to distinguish between manufacturing proper and mere bulk production.

A Question of Service.

Individually simple instrumental parts may, when played together, sound tremendously difficult. So simple machine-shop processes, properly directed, may produce pieces which, when completed or drawn out on paper, appear extraordinarily difficult and quite commercially impossible. If one expensive-looking piece will do the work of a unit built up of two or several simpler pieces, and have the merit of being less clumsy, with a probability of giving better service, it is always worth considering whether the expensive-looking piece is so bad from a manufacturing standpoint as it appears superficially. Again and again experience shows that it will not be so—if it is to be made in numbers. Here is an actual instance.

A unit built up of two pieces was a continual source of trouble. The makers were loath to abandon the design of which the unit formed a part on account of its general excellence. There was one solution, however, ideal in some respects, which had never been seriously considered because it involved an unusual boring operation. It depended on the possibility of cheaply boring a hole, not round, but shaped like a circle with four evenly-spaced flats, each subtending 30 degs. at the centre. Broaching was out of the question, so boring was tried and was found successful in every way. The piece is now being produced in large quantities accurately and cheaply on an automatic chucking machine. Moreover, the method employed is universal in application. Within certain limits a hole or bar (for with modifications a like method can be applied to turning) can be produced of any shape desired—elliptical, for instance. Furthermore, the longitudinal section need not be rectangular; it may be "barreled" or of any simple curved form, and can be produced without the use of a single form tool. The rate of production is nearly as high as for plain work. The error need not exceed 0.002 in. in diameter. One may safely assert that the possibilities this reveals are in excess of any likely requirements in its range for many years to come.

It is worth noting that the draughtsman seeking advice on some question of manufacture is usually most concerned and worried over features which make little or no practical difference. Real difficulties often arise from such insignificant-looking causes that the same draughtsman would lightly ignore them.

Need for Getting Out of the Rut.

If a designer be not already expert in shop practice, one cannot anticipate that he ever will be. Even a few years of office work destroys much of an engineer's familiarity with shop practice in the minor details; his knowledge gets rusty. For these reasons, most designers may desirably be instructed to take the utmost licence; to aim at excellence, and forget cost for the preliminary trial plans. Cost may be taken into account at the second attempt, after discussion with the manufacturing authorities. Though counseled to take the wildest freedom, few men would shake themselves free from the fetters imposed by early training, and be really bold. Few would cause so much trouble to the manufacturing experts as would some junior fresh to the business.

An an example of how prevalent ideas need modification, the following example will serve. One is taught to design shafts with as few steps as possible in order to economize the machinist's time. It is asserted that every additional step will consume extra time for gauging. Presumably the same reasoning applies to short stems and boring on a chucking machine. No doubt the theory is true enough for old-fashioned conditions, but a number of steps is frequently a great advantage on a manufacturing machine, because they can be turned simultaneously. As for gauging, but little is required after the first "set-up." Most work required within fine limits of error is ground nowadays, and it is quite certain that any little extra time in grinding several different diameters would never balance the time previously saved; it might generally be ignored.

Grinding.

Speaking of grinding brings to mind grinding with form wheels. One well-known instance is the grinding of crank-shaft journals with a wheel the same width as the journal itself. This is purely form grinding, and should not be confused with the ordinary method. Any profile can be ground providing the diamond can be made to trace it out in the wheel in a suitable manner. The simplest examples are a straight line and an arc of a circle.

There is hardly a limit to the shapes which can be milled. Internal shapes can be broached; or if that be impossible, it is perhaps permissible to modify the design a little, treat it as a gear problem, and cut the work on the Fellowes gear-shaper. With these three methods, the manufacturing time may most likely be hardly any longer on an intricate than on a plain shape.

One last process may be mentioned—die-casting. Here, providing the present limited range of metals which may be cast in dies can supply him with one having the qualities he needs, the designer can work his will very freely. The advantage to him is not so much that he is at liberty to call for fantastic shapes if he has the mind, as that the design can be more refined than is practicable with the ordinary machined casting, and probably less expensive unless his requirements are extremely simple.—Engineering.

MUST FACE UNEMPLOYMENT EVIL.

"UNEMPLOYMENT is not merely a matter of statistics to juggle with," declared Mr. G. E. Jackson, of the Department of Economics in University College, during the course of an address before the Social Science Club at McMaster University recently.

"This problem of unemployment must be looked at in its proper perspective and in human terms. There is danger of our getting out of touch with the fact that unemployment results in actual suffering in the lives of the people affected. Their physiques are impaired, their stamina is lessened, and some of them are driven to crime.

"The greatest need in connection with this question is more knowledge. We know a certain amount—for example, we know that bad winters come with quite remarkable regularity, and, therefore, can be warned to look out for unemployment before it comes, and we know the causes of unemployment. What we do not know in regard to the situation in Ontario is the real extent of unemployment, what proportion of it is due to seasonal causes, and what to cyclical, what amount of work could be provided for men in the Canadian woods in winter, and, among the unemployed, the proportion of good workers and those known as 'work-shy.'

"The question has been taken up by the Social Service Commission, in the Ontario Legislature, and by the Church, and the discussion on all three of these sides has been of great value. What will happen now will depend entirely on what interest the public takes. Those who are interested should agitate and keep the question to the front. It is not merely a local phenomenon which will not reappear. There will be more or less unemployment next winter and every winter, and at some fairly well-defined intervals there will be another heavy attack of the same disease."

Mr. Jackson said that a university course should be a training for public life. It must not turn out merely technically trained men, but men who will take a broad view of social problems such as unemployment.

Eric Buckler, of Calgary, sailed last Saturday from the Old Country, with a member of the great china manufacturing firm of Doultons, to examine the china clay deposits of South Alberta, and possibly to start a factory.

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

BORING A HOLE TO MATCH CAST BOLT HOLES.

By F. H. MAYOH.

THE purpose of this article is to describe an accurate method of machining the piece shown by Fig. 1: the word accurate in this case meaning, handling the work in such a manner that when the centre hole (A) is placed in a chuck and bored, the two small holes at the sides which are cast in the piece will come in the correct position to slip over two bolts in the piece that this one matches with when assembled in place. After these castings come from the foundry they are snagged and sent to the turret lathe where they are handled as follows:

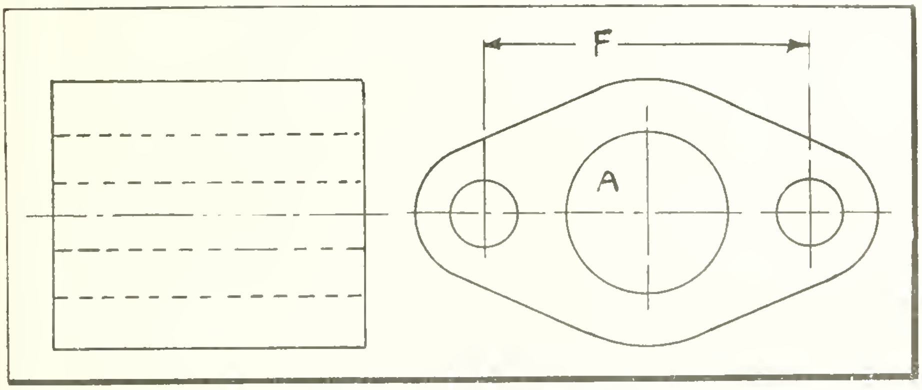


FIG. 1. PIECE TO BE MACHINED.

First, the piece is placed in a two-jaw chuck which has special jaws as shown by Fig. (2). Here, the hole in the centre is bored and reamed with the tools shown, after being lined up by the gauging plate (B) which, for convenience, we will say is placed on the first turret face, and consists of a shank (C) upon which is mounted a cast iron plate (D) with two studs (E) held in it. These studs are made a little larger than the bolts that go through the work being machined, and are set to correspond to these bolts for centre distance (F), Fig. 1.

After setting the work in the chuck, it is tested by this plate to see if the small cast holes are in the correct position by bringing the turret forward with the first turret face which carries the gauge in the correct position for trying the studs in the holes to see if they line up, or if they are in the correct position for boring the centre hole. If not correct, the chuck is adjusted in the usual manner until a satisfactory alignment is secured, then the work is rough bored by a flat cutter and bar (G), and rough-faced by a tool (H) held by the second turret face and front cross slide block respectively. Next, the turret indexes, bringing the finish boring bar (I) with pin cutter into position for finish boring, while the work is finish-faced by a tool similar to (H) but opposite hand and held by the rear cross slide block.

To complete this operation and leave the hole in a good smooth condition, true to size, it is now reamed by the reamer (K) on the fourth turret face, and layed one side ready for the second operation of facing the rough end nearest the chuck. This is accomplished by placing it on an arbor, Fig. 3, in the engine lathe and facing it by tools held on the cross slide similar to those used for the first operation, thus completing the machining on this piece in a neat manner, and insuring against having the small holes and the large centre holes coming in all sorts of places but the correct one.

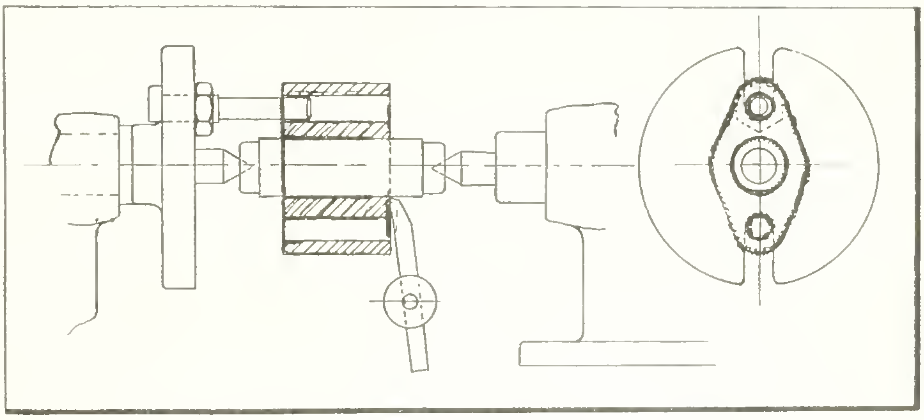


FIG. 3. LAYOUT OF SECOND OPERATION TOOLS.

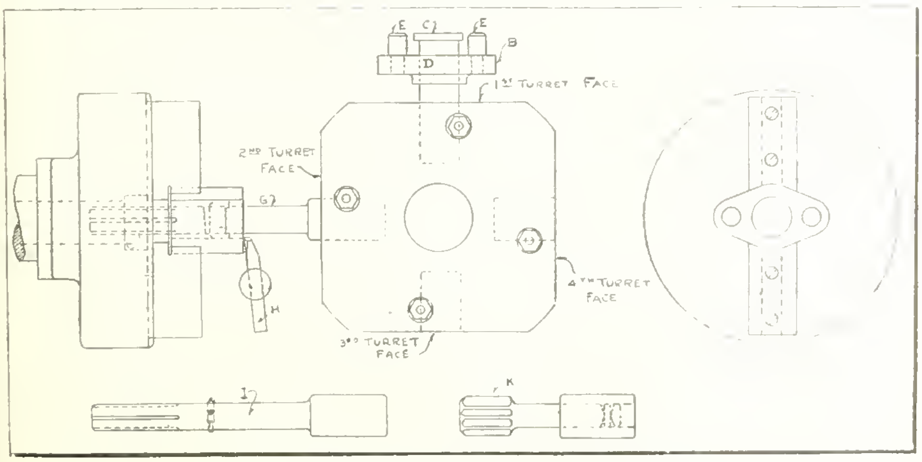


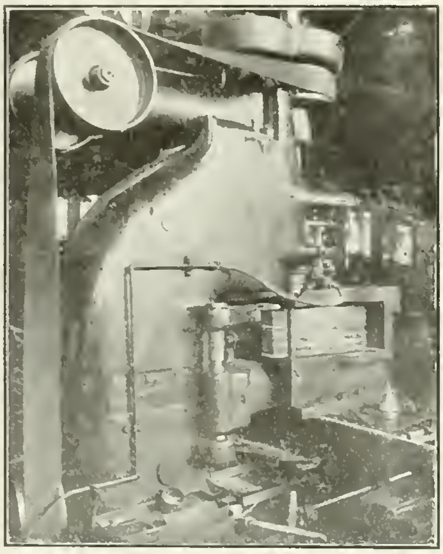
FIG. 2. LAYOUT OF FIRST OPERATION TOOLS.

MILLING PASSENGER CAR PEDESTALS.

By A. E. W.

THE accompanying illustration shows the method adopted by the Canadian Pacific Railway at their Angus Shops, Montreal, for machining passenger car pedestals. The work is done very expeditiously on a No. 8 vertical milling machine built by Alfred Herbert, Ltd., Coventry, England. The pedestal plates are milled in batches of seventeen at a time,

being held in a special fixture, as clearly seen in the half-tone. The gap to be milled is 19½ inches deep by 14 inches wide, with a 3¼-inch radius at the top corners. About ½-inch of metal has to be removed, this being done in one cut. The plates are ¾-inch thick, so that the total thickness to be milled is 12¾ inches. This is done by a cutter 13 inches long by 6½ inches in diameter, which is piloted at its lower end by an arbor support, or steady bracket, supplied with the machine and observable in the illustration. This arbor support plays an important part, as without its use it would of course be practically impossible to get a smooth finish, unless a much lighter cut were taken.



MILLING PASSENGER CAR PEDESTALS.

This machine has feeds 62 in. x 28 in. x 38 in., and is understood to have been the means of greatly reducing the cost of milling the pedestal plates at the Angus Shops.

STANDARD LATHE ARBORS.

By R. C. Dickens.

IN ordinary shop practice little effort is made as a rule to standardize ordinary shop tools, such as plug gauges, reamers, solid and expansion arbors; the result is a motley collection of tools, each designed for the job at hand and largely by guess. I have endeavored to show by means of the accompanying drawings that, by a judicious use of tabulated sheets, the tool equipment of the average lathe department can be much improved both as to uniformity of product and efficiency of operation. The same line of reasoning applies to tool equipment for machine tools as to the machine tools themselves—that is, when machine tools are all of one make less confusion is occasioned when transferring men from one machine to the other, for, if the workman be familiar with one machine, he is familiar with all.

In the drawings above mentioned four types of expansion arbor are shown for four distinct lathe operations. The type shown in Fig. 1 is used for that class of work which requires to be finish turned to a certain diameter and faced to length, having been previously bored and faced on one end. No difficulty will be experienced in determining the class of work on which it may be employed.

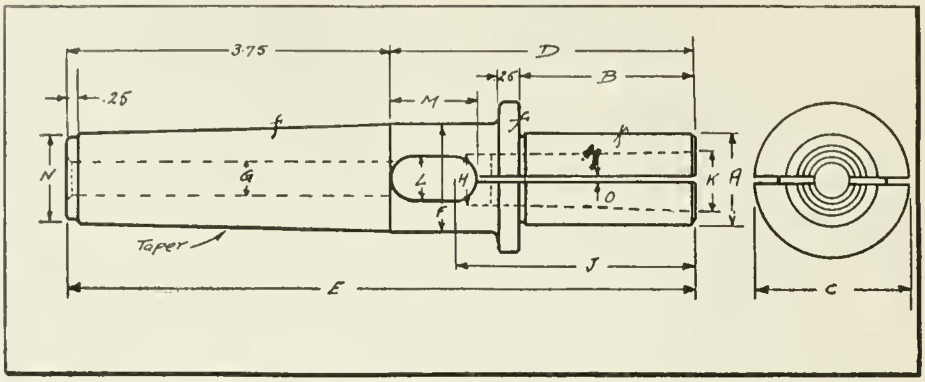


FIG. 1. STANDARD LATHE ARBORS.

Expander

Dia of arbor Including	To	X	Size of Expander		Length of Expander	G.	Counterbore H	J	K	O	Size of Lathe
.50	.750	.75	No 0 Morse		E + 1.25	.265	——	——	.356	.031	12-16-18
.750	1.125	.75	" 1	"	" " "	.328	.375	2.25	.475	.062	All
1.125	Larger	.75	" 2	"	" " "	.390	.580	2.75	.700	.062	All

	D
When B = X or is less	$X+\frac{3F}{4}+.25$
When B exceeds X	$B+\frac{3F}{4}+.25$
Shank dia "F" to be expressed in nearest 16th	

Shank.

Size of Lathe	Taper	F	L	M	N
12-16-Sleeve	No 3 Morse	1.00	.25	.50	.687
18-Sleeve	" 4 "	1.230	.312	625	.987
16-Spindle	50 per foot	1.5675	.375	.750	1.312
20-Sleeve	No 5 Morse	1.720	.437	.875	1.437
18-Spindle	50 per foot	1.75	427	.875	1.50
20 Spindle	" " "	2.378	.562	1125	2.125

FIG. 1. TABULATED SIZES.

Fig. 2 shows an arbor of the same general style, but used on bushings that have previously been bored and faced on one end, and which it is desired to face throughout the entire length. Figs. 3 and 4 are for bushings, as illustrated by drawings (c), which, having been bored, it is desired to finish, turn and face to length in one operation, using a gang tool for the facing operation set to the length required. The arbors shown in the last two figures are for similar work, only of a heavier duty nature.

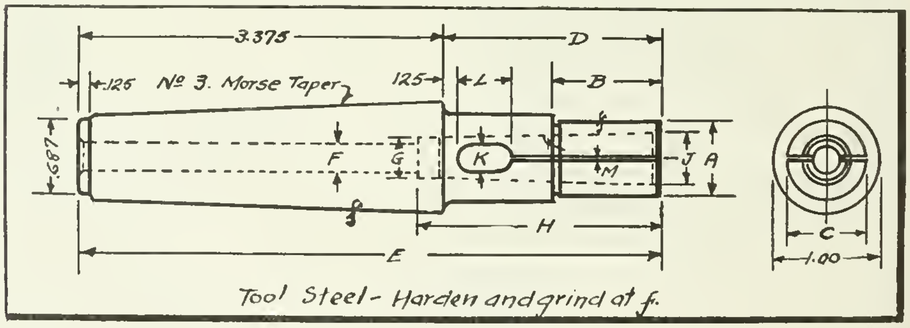


FIG. 2. STANDARD LATHE ARBORS.

Dia. of Arbor From	Including	X		D	F	G	H	J	K	L	M	Expander Size	Length
.312	.50	.625	When B=X or is less	X+.75	.203	—	—	239	.250 to nearest 1/16 smaller	2K	.031	BAS #1	E+1.00
50	6875	1.125	When B exceeds X	B+75	.265	—	—	356			031	Morse #0	E+1.25
.6875	875	1.125			328	.375	225	475			.062	Morse #1	E+1.25

FIG. 2. TABULATED SIZES.

In order that there may be no confusion, I will set out the figures for an arbor of the type shown in Fig. 1 for a

bushing bored 1 in. diameter and $1\frac{1}{2}$ in. long.

A would equal 1—.002.

B would equal $1\frac{3}{4}$, allowing $\frac{1}{8}$ in. for clearance.

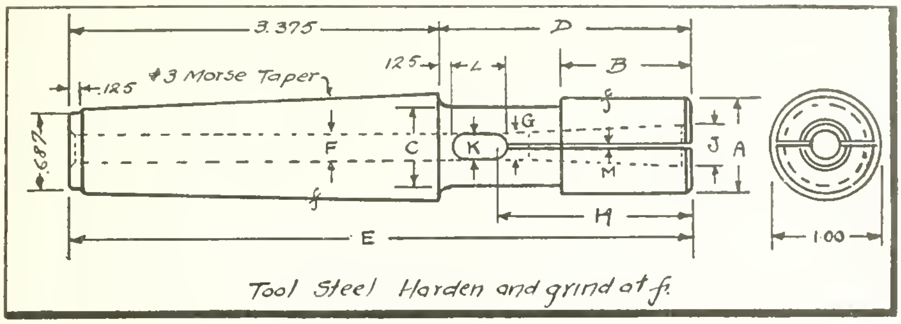


FIG 3. STANDARD LATHE ARBORS.

$$D \text{ would equal } 1\frac{1}{2} + \frac{3 \times 1\frac{1}{4}}{4} = 2\ 7\text{-}16,$$

because, in the case under consideration, (B) is greater than (X), and we are going to put this job on a lathe having a socket or sleeve with No. 1 Morse.

X would equal .75.

Size of expander would be No. 1 Morse.

E = $3\frac{3}{4}$ + 2 7-16 = 6 3-16.

Length of expander = 6 13-16 + $1\frac{1}{4}$= 7-16.

All other dimensions are given in table.

Dia of arbor Including	To	C	X		D	F	G	H	J	K	L	M	Expander Size	Expander Length
375	625	A-062	625	when B = X or is less	X+75	203	—	—	239	.250 to nearest 16th smaller	RK	031	3+5 No 1	E+1.00
625	.875	A-125	1.125	when B exceeds X	B+75	265	—	—	356			.031	Morse No 0	E+1.25
.875	1.125	A-125	1.125			328	.375	225	475			.062	Morse No 1	E+1.25

FIG. 3. TABULATED SIZES.

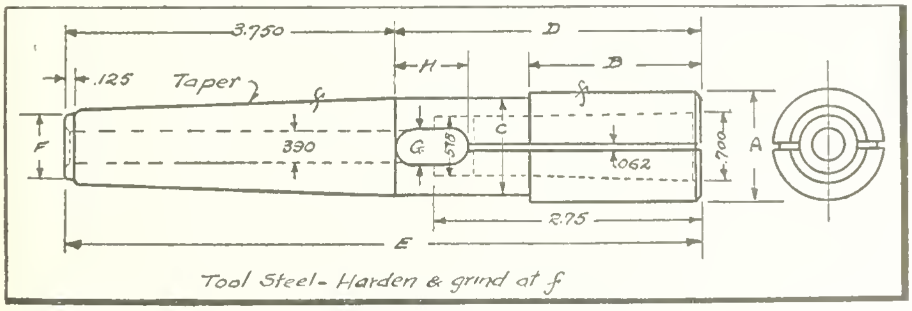


FIG. 4. STANDARD LATHE ARBORS.

The expander is simply a plug of the required taper, as shown by table, and having a straight stem long enough to make the length, as given in table, allowing about $\frac{1}{4}$ in. of tapered end to project in order that the arbor may be tightened by striking with hammer. The arbor may be loosened by the use of the ordinary rod in common use to bump out centres. The big advantage that this type of arbor has over others is the fact that work can be removed without removing arbor from lathe.

I would like to say that the arbors in this drawing are used with LeBlond lathes, but could be used with any lathe with such changes of the fixed dimensions as may be necessary.

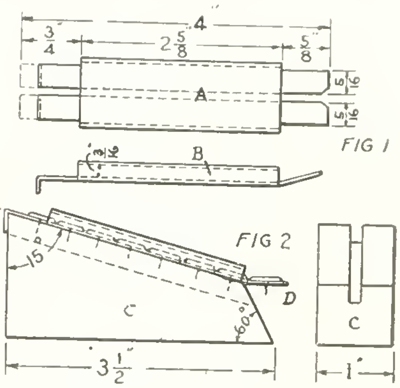
Size of Lathe	Taper of Shank	C		D	F	G	H	Expander Size	Expander Length
12 & 16 Sleeve	No 3 Morse	1.000	when B = 1.00	$1.00+\frac{3C}{4}$	687	25	50	No 2 Morse	E +1.250
18-Sleeve	" 4 "	1.230	or is less.		937	312	625	"	"
16-Spindle	50 per foot	1.5675	when B	$B+\frac{3C}{4}$	1.312	.375	750	"	"
20-Sleeve	No 5 Morse	1720	exceeds 1.00		1.437	.437	875	"	"
18-Spindle	50 per foot	1.757	C to be expressed		1 50	437	875	"	"
20-Spindle	" " "	2.378	in nearest 16th		2 125	562	1.125	"	"

FIG. 4. TABULATED SIZES.

THUMB-TACK LIFTER.

By James E. Cooley.

When taking out thumb-tacks from a drawing-board they sometimes cling to the hole in the paper or roll off the board as the paper curls up. In the accompanying sketch is shown a tack-lifter that picks up thumb-tacks, releases them from the paper, and holds them, ready for immediate use. In Fig. 1 is shown a piece of sheet-steel bent in the shape indicated, having one end filed, beveled for a claw. As seen, the tacks can be slid up the track (A) as fast as they are taken from the board. The point of the tacks already on the track in no way interfere, as they raise up when in contact with the board; the enclosed area (B) being high enough for this purpose. The inclined block (C), Fig. 2, is made of wood, and is used for holding the lifter when filled with tacks.



THUMB TACK LIFTER.

As illustrated, the tacks will slide down the incline, and can be picked off the step (D) as fast as wanted.

To Distinguish High-speed Steel.—Three kinds of steel are in general use for cutting tools, i.e., high-speed, self-hardening, and carbon. When they are unmarked, it is a puzzle to tell offhand which is which. Self-hardening can be distinguished by its always hard condition. High-speed can be told from carbon steel by grinding a little on an emery wheel. The sparks which it gives off are a dull red (much like those from self-hardening), and do not fly off at much of a tangent to the wheel, but keep close to it and die out quickly.—D.A.H.

Drilling Suggestion.—For clearing the cuttings out of a deep hole, or when starting the drill on a hole that has been marked off, most drillers blow off the cuttings with their mouth, or use a blow pipe, so that they can see if the drill is running true to the lines. A much cleaner and quicker method is to get an old round file magnetized. This will readily lift the cuttings from the deepest hole, a light tap on the side of the job dislodging them. When starting the drill it will pick up all cuttings and you can then see what the drill is doing.—J. Davis.

Winnipeg, Man.—The Manitoba Cold Storage Co., will build an addition to its plant.

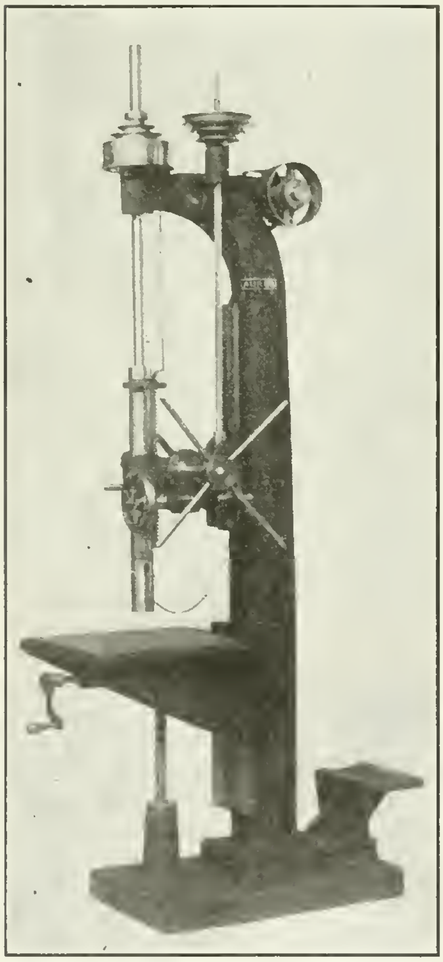
DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

BALL BEARING HIGH SPEED DRILL.

THE illustration represents a high speed drill equipped with both hand and power feed, 14 in. adjustment to the slide, 14 in. travel in the head, and 14 in. adjustment to the table.

A number of these drills were furnished the plant of the Fort Wayne Electric Works of General Electric Co., Fort Wayne, Ind., and were built to specifications furnished by their mechanical superintendent. These drill presses are designed for heavy duty work in driving multiple spindle drill heads of the Langelier and other simi-



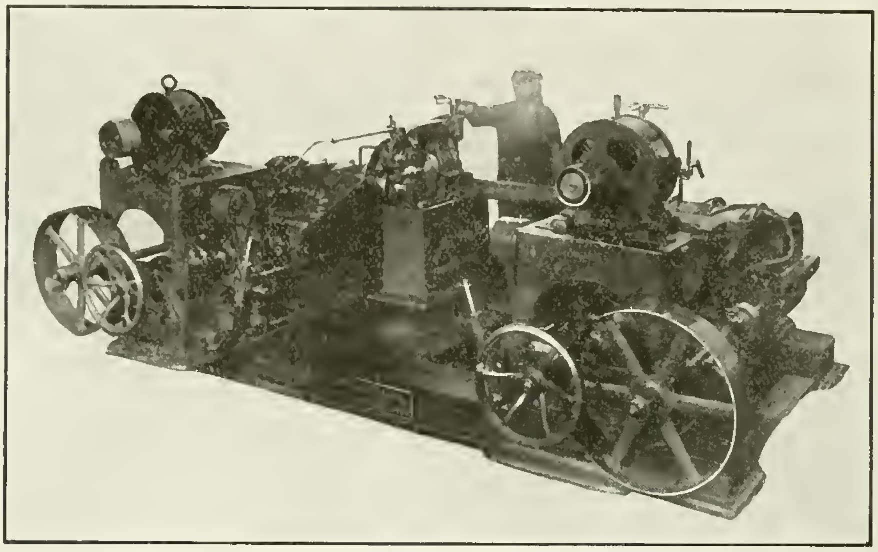
BALL-BEARING HIGH-SPEED DRILL.

lar types in which as high as eight 3/8 in. drills are required to operate simultaneously.

The machines are driven by a direct current "Fort Wayne" motor mounted on a bracket on the base. For the particular class of work for which these drills are to be used, a constant speed motor is used, driving the spindles at 1,800 r.p.m., but if a range of speeds is desired, a variable speed motor can be used, or the motor bracket can be replaced by a bracket supporting a cone pulley. Three feeds are secured through the feed cone pulleys on top of the machine, which are .005 in., .007 in., and pulleys are mounted on high grade ball bearings, and the spindle is supplied with a ball thrust bearing which reduces .010 in. per revolution of spindle. The friction to a minimum. The above drills were built by the Aurora Tool Works, of Aurora, Ind.

NEW COLD SAW CUTTING OFF MACHINE.

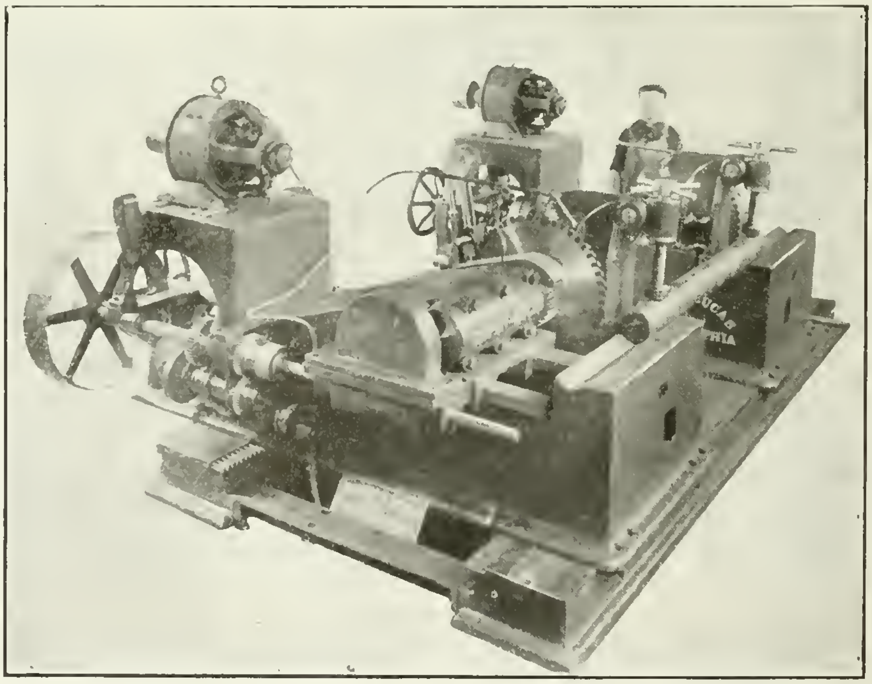
THE accompanying illustrations show a rapid production duplex cold saw cutting off machine intended for cutting



NEW DUPLEX COLD SAW CUTTING-OFF MACHINE—REAR VIEW.

off both ends of axles at one operation. It has recently been built by the Espen-Lucas Machine Works, Philadelphia, Pa.

The machine is equipped with two 26-



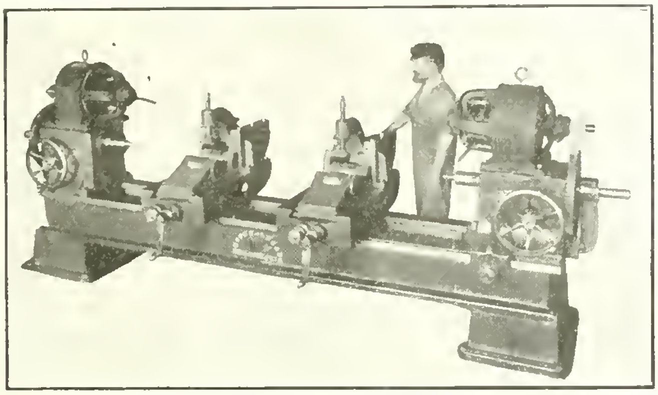
DUPLEX COLD SAW CUTTING-OFF MACHINE—FRONT VIEW.

inch saw blades with special inserted teeth, and has a capacity for cutting off both ends of 7-inch axles at the rate of twelve to fifteen axles per hour. Feed and speed variations are provided that will permit of the machine sawing off materials at an advance of six inches per minute, though such a feed is not likely to be required in actual practice. The cutting capacity, it is stated, is limited only by the nature of the steel to be cut and by the endurance of the high speed steel in the cutters of the saw blades. This product is said to be the most powerfully geared and liberally proportioned machine of its capacity yet built. It is driven by powerful compound gearing, steel worm and bronze worm wheel. The main bed and table are heavy castings, reinforced with stiff webs, while the saw carriages are extremely wide and long, with ample bearing on the base.

The saw blades are bolted directly to the driving gears, and the latter are forged integrally with the ends of the spindles. This form of construction eliminates the development of torque or other lost motion between the saws and the gears, and gives a bearing for the spindle the full width of the saw carriages. This drive is claimed to be a great improvement over the old type, in which the driving gear was placed at the centre of the spindle, thereby developing torque and weakening the saw carriage.

All gears are cut, and together with the spindles, shafts, etc., are made from high carbon forgings, well hammered. All bearings are bushed with bronze, and the thrust of the driving worm and other rapidly-revolving parts is taken up by roller bearings. The feed is of the friction type, and is variable and automatic, being controlled by an automatic stop which regulates the depth of the cut up to the full capacity of the machine. The saw carriage is equipped with automatic power return and automatic starting device. That is to say, the feed can be adjusted so that as soon as the saw has cut through the axle, it returns to the beginning of its travel and then commences to advance again, thus leaving the operator free to give his whole attention to feeding axles to the machine and removing them when finished.

A copious flow of cutting compound is directed on the saw teeth during operation by two circulating pumps, and the axle is held down in place by two pneumatic clamps. Each saw is independently driven by a 15-h.p. motor, and the total weight of the machine is approximately 30,000 lbs. The Canadian Fairbanks-Morse Co. sold one of these machines to the Canadian Car & Foundry Co., who have installed it in their new plant at Fort William, Ont.



DOUBLE END AXLE CENTERING LATHE.

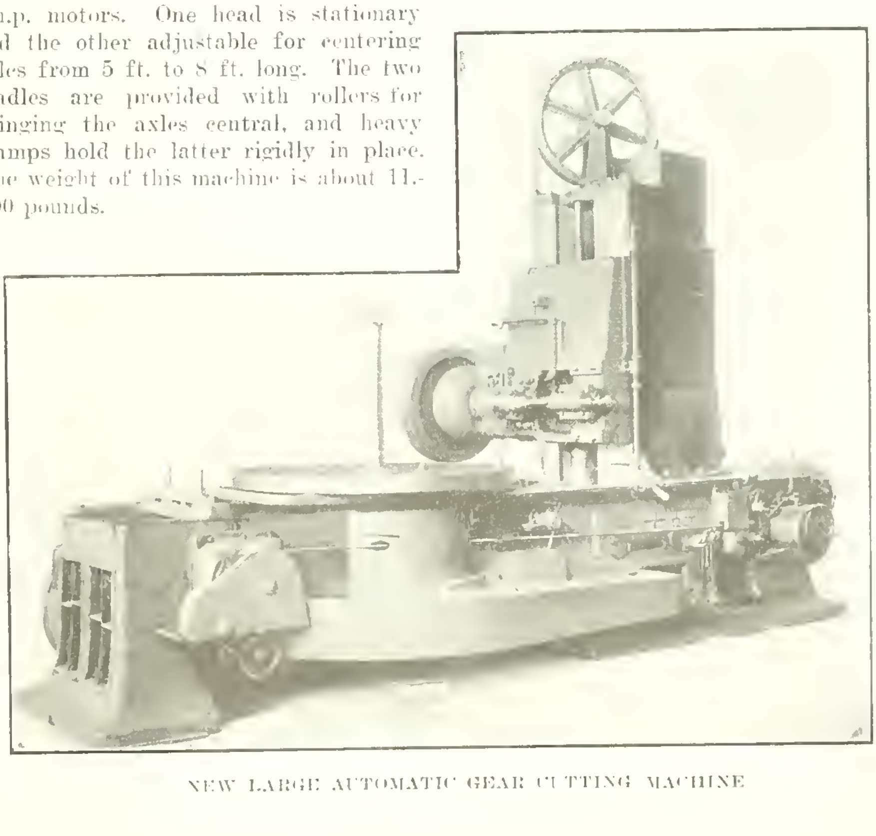
After being cut off in the foregoing machine, the axles are centered in the double end centering machine illustrated. This was also built by the Espen-Lucas Machine Co., and has a capacity for centering axles up to and including 7 inches in diameter by 8 feet long. The machine is arranged with two spindles independently driven by two 2-h.p. motors. One head is stationary and the other adjustable for centering axles from 5 ft. to 8 ft. long. The two cradles are provided with rollers for bringing the axles central, and heavy clamps hold the latter rigidly in place. The weight of this machine is about 11,000 pounds.

NEW LARGE AUTOMATIC GEAR CUTTING MACHINE.

GOULD & Eberhardt, Newark, N. J., have built for Foote Bros., Chicago, a large gear cutting machine, and will cut spur gears up to 144 inches diameter by 24 inches face. It has capacity for cutting steel gears up to 4 inches circular pitch. This machine is of the vertical cutting type and, owing to the very heavy gears for which it was designed to cut, the indexing worm wheel is mounted in a fixed position and the stanchion carrying the cutter slide is adjustable by hand or power to accommodate different diameter gears and for setting the depth of cut.

The cutter spindle is driven by a powerful worm and worm wheel, with a heavy fly-wheel mounted on the end of the main spindle. The cutter arbor is 3 inches diameter, and will take cutters up to 14 inches diameter. An auxiliary cutter spindle is also furnished. It is driven through hardened helical gears from the main spindle. Cutters of ordinary dimensions may be used and a great variety of sizes from small pinions to the largest gears, may thus be handled. The machine is entirely automatic, and has many of the features of the firm's well-known smaller machines. A wide range of cutter feeds and speeds is provided, and the cutter feeds which are independent of the speeds may be conveniently changed through an improved gear box.

The indexing worm wheel is of the split rim type, extremely and accurately hobbed. The indexing and feed mechanisms are connected with a system



NEW LARGE AUTOMATIC GEAR CUTTING MACHINE

of interlocking levers so arranged that it is impossible for the feed clutches to engage until the indexing has been completed and accurately performed. A system of oil pans completely cover and guard the worm wheel and keep the floor clean, while a large oil pump provides a generous flow of cutting lubricant to the cutters. The speed of the indexing wheel may be varied to suit various size gears.

The machine is also arranged so that worm wheels may be hobbed automatically from the solid without previously gashing the teeth. The cutter spindle is geared in unison with the indexing worm, and single or multiple thread hobs may be used with equal facility. The cutter slide may be locked securely in any desired position for hobbing, and an automatic feed, gradually feeds the hob into the wheel. The weight of the machine is about 35,000 lbs.

NEWTON RADIUS LINK GRINDER.

THE Newton Machine Tool Works, Philadelphia, Pa., have recently added to their standard machine tool designs and products the Radius Link Grinder here illustrated. Its construction was the result of a call by a large firm of locomotive builders for a machine capable of grinding the hardened radius links which are now required to meet the exigencies of service conditions. The original machine is known as an 11,000-pound Radius Link Grinder, and is now in successful operation.

Investigation showed that the links had faces to be ground in different widths up to 5 in., and, while the latest designs with the widest faces permitted of the use of large diameter grinding wheels, the older types had only 1 in. of clearance at the end of the radial surfaces for clearance. This necessitated grinding wheels 2 in. or less in diameter, and as such wheels compelled the use of small diameter arbors to carry the emery wheels, it was deemed unwise to figure on grinding the entire width of face at all times, as was done on the larger sizes. The small diameter wheels are, therefore, made only 1-in. face for ¼-in. feed at each stroke, and the entire width of face is covered by a continuous vertical feed to the main spindle saddle. When using the large diameter wheels, the auxiliary saddle has a reciprocating feed of about ¾ in., to insure even wear on the wheel to give a parallel surface.

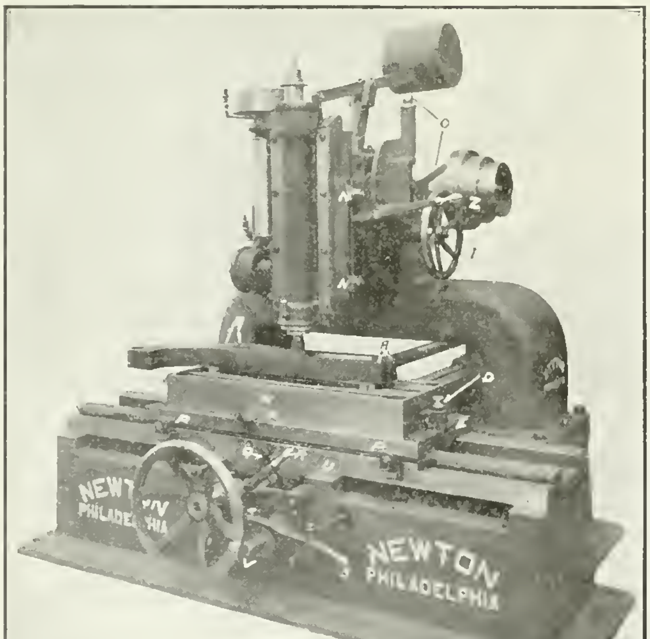
In actual operation the links are located on the fixture mounted on the top table by suitably located pins. The radius, gauged at all times from the centre of the link to the centre of the pivot (B), is measured by the scale (C), and the maximum capacity is for links up to 100 in. radius, and of approximate length of 42 in. To insure maintaining central location of the work table while changing the radius for the various size links, pins (D) mounted on both ends are temporarily inserted in hardened steel bushings in the cross slide (E).

After setting the link, the machine is started, and the hand-operated clutch (F) controlling the reciprocation of saddle (G) is engaged. The main saddle (H) is then lowered by means of the wheel (I) until the emery wheel bears the proper relative position to the face to be ground. During the operation the main saddle feed is made inoperative through the latch lever (J), which holds the feed-operating clutch neutral.

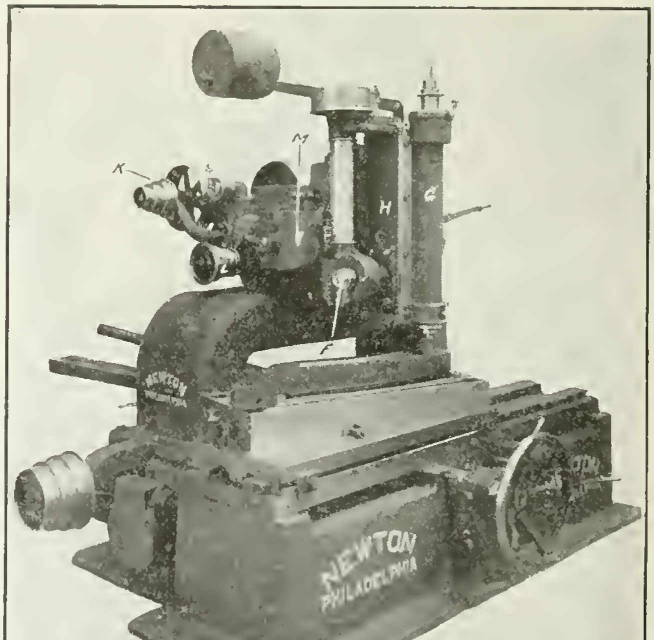
When the small diameter narrow face wheels requiring the feed are used, the reciprocation clutch (F) and the neutral feed latch (J) are disengaged; then the constant feed to the main saddle (H) is operative. Motion for this feed is taken from the feed cone (K) on the main driving shaft to (L), and through the double train of bevel gears in the box (M) to give the levers motion. The length of feed is controlled by the trips (N), which are so arranged that when the extreme length of travel up or down has been reached the direction of movement of the saddle is automatically reversed, and to eliminate undue dwell at the end of the stroke a spring roller latch is incorporated at (O).

After properly locating the grinding wheels, the trips (P) on the cross slide are adjusted for the length of the travel. These engage pawl (Q), the action of which is to reverse the direction of travel, and is quickened by a spring roller latch. Lever (R) mounted upon the shaft with trip (Q) permits of stopping the table at any desired point, and lever (S) controls the neutral latch for the table traverse mechanism. Hand wheel (T) in the position illustrated controls the in-and-out adjustment of the bottom saddle (U) for depth of cut, and when fitted onto the square end of shaft (V) hand cross motion of the slide (P) is possible.

To permit the work table (W) to follow the radius being ground, the table

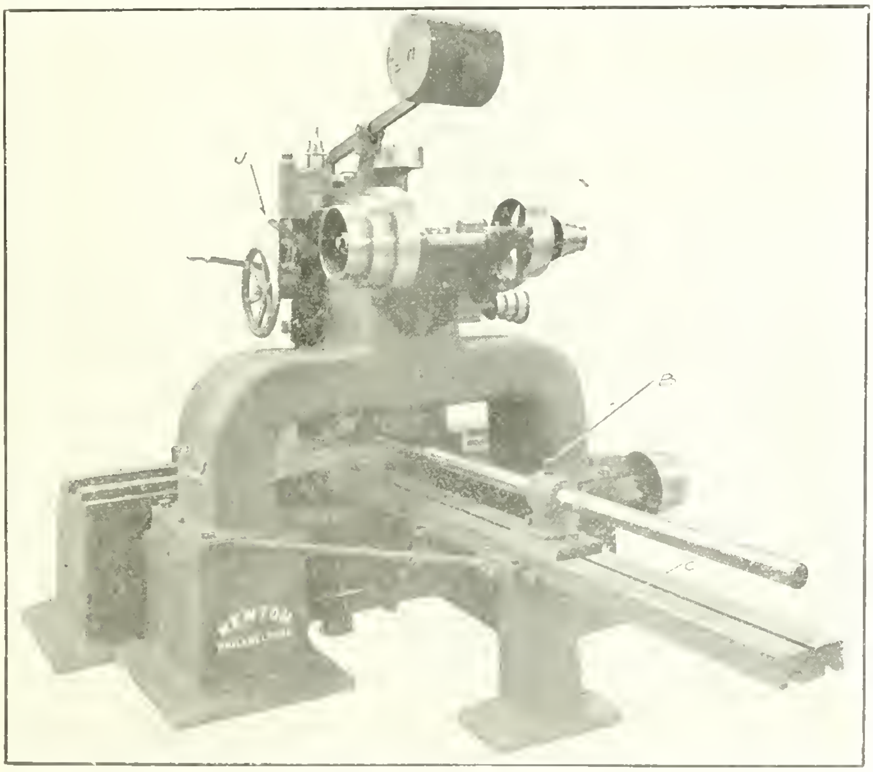


NEWTON RADIUS LINK GRINDER.



NEWTON RADIUS LINK GRINDER.

clamp (X) is pivoted to the cross slide (P). As the radius bar (Y) is attached directly to the slide (U), adjustments for depth of cut and from side to side of the links are made without disturbing the radius, and also, without re-setting the work, parallel radii are ground. With this design beyond clamping the work on the table and adjusting for depth of cut, and from side to side of link, all operations are automatic. The main drive for the countrshaft is received at pulley (Z). The spindle of the machine varies from $2\frac{1}{8}$ in. to $2\frac{1}{4}$ in. in diameter, and is supported with self-centering ball and taper roller bearings with take-ups, which arrangement eliminates any possible wear of the spindle. The spindle speeds range up to 5,000 r.p.m. per minute. As shown in the photographs, proper counterweighting is provided for. On account of the difference in weight of the saddles (H) and (G), the connecting of the one weight to each of these has been made through a horizontal compensating link.



NEWTON RADIUS LINK GRINDER.

Since watching the operation of this machine, the makers are considering the exhibition of a duplicate at the Master Mechanics and Master Car Builders' Convention this year, if unforeseen conditions do not prevent.

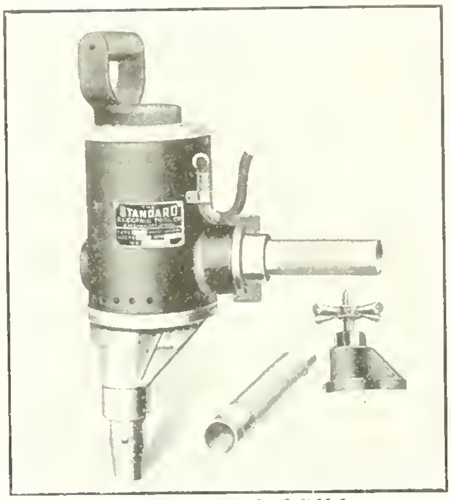
The Canadian-Allis Chalmers, Ltd., Toronto, have been appointed sole agents for Canada and Newfoundland, for Avery's, Ltd., Birmingham, Eng., scale manufacturers.

NEW UNIVERSAL DRILLS AND GRINDERS.

THE Standard Electric Tool Co., of Cincinnati, Ohio, have developed and are now placing on the market a new line of portable electric tool post grinders. These operate on both direct-current and alternating-current, 0 to 60 cycles, being developed particularly to meet the demand for operation on 25, 30 and 40 cycle circuits. The grinders are ball-bearing and are encased in dust-proof chambers packed in grease. This eliminates oiling, and prevents flooding with thin oil and damaging motor windings, as well as precluding the possibility of trouble from improper bearing adjustment. These tools are manufactured in 1-6 and $\frac{1}{4}$-h.p. sizes, and they have a speed of approximately 6,000 r.p.m., which makes them very effective for internal grinding.

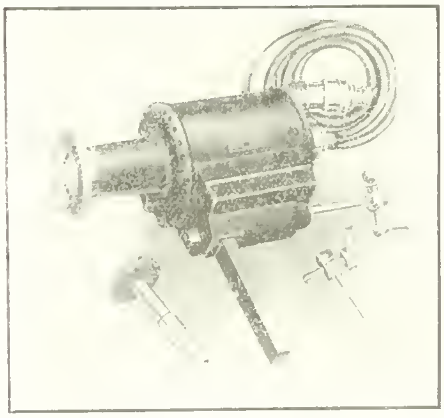
In addition to the above grinders the company are placing on the market two new sizes of Universal drills, $\frac{5}{8}$-in. and 1-in. capacity. These are in addition to the seven sizes they have had on the market for some time and which were illustrated and described in these columns at an earlier date. The drills operate on both direct and alternating current, 0 to 60 cycles, and as with the grinders are especially adapted for 25, 30 and 40 cycle circuits. Drills are ball-bearing throughout. The $\frac{5}{8}$-in. size is fitted with No. 2 Morse taper socket or with chuck, and the 1-in. size with No. 3 Morse taper socket. Gears are generated from a special grade of steel and are case-hardened, and run encased in grease.

Motors in both grinders and drills are form wound and are impregnated in Bakelite, which method of winding and insulation prevents grounds, short cir-



NEW UNIVERSAL DRILL.

cuits and other troubles incident to high speed apparatus if constructed according to slow speed motor practice. All tools are air-cooled by means of a high power fan. These motors are capable of overload without damage. The idea of staple rigid construction has been followed throughout, although weight has



NEW UNIVERSAL GRINDER.

been kept down to the minimum. Both drills and grinders are built on the unit plan, which makes them easily dismembered. All electrical connections are made in the frame unit.

The $\frac{5}{8}$-in. and 1-in. sizes of drills have also been added to their line of drills for direct current only, as well as for two and three phase alternating current.

Ask $13,748 From C.N.R. The Canada Iron Corporation, Limited, and the Montreal Trust Co., and Edgar McDougall, liquidators, have entered action at Osgoode Hall against the Canadian Northern Railway Co., to recover $13,748.01, alleged due for goods sold and delivered.

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Vol. XI. MARCH 26, 1914 No. 13

PRINCIPAL CONTENTS.

PRICE CUTTING IN THE FOUNDRY.

THE present money stringency has brought with it a great many results, most of them characterized as evil though they may not be without a grain of good. If money be scarce and more expensive, other commodities must necessarily be cheaper when compared with it, and naturally, the first prices to fall are those in connection with the production of the elementary commodities, among which those of the foundry are, by no means, the least important. From the manufacturer's point of view, it seems only fair that the price of labor or the price of his production should adjust itself to the variations of the standard—money.

Price cutting must be distinguished from cost cutting in that it refers particularly to the piece-work prices paid the moulders and not the cost of melting, supplies and overhead charges. The necessity of this reduction should, theoretically, be as frequent as the possibility of a general rise in wages, and, if tact and judgment coupled with fairness be applied, the undertaking will be robbed of many of its disagreeable features.

Price cutting naturally divides itself into two general classes. First: that which is accomplished by simply reducing the prices to the moulder and which proportionately reduces his remuneration. This may be occasioned by "hard times," an unreasonably high price being paid for the job in question, or the selfish desire of the foreman for notoriety, or the manufacturer for increased profits.

Second, that which is brought about by reducing the mechanical effort required of the mechanic, making it possible for him to produce more, and thus lower the quantitative cost. This has many advantages in that it often decreases the wear and tear of tools and appliances, and decreases the quantity of materials required. It is also nearly always more satisfactory to the moulder himself.

If a cut in prices be deemed necessary, it should go into effect upon starting the job after it has been for some time out of the sand, or, if it be possible to change the job from one method of moulding to another, even though the actual labor of production be not decreased, it can be classed as a new job with a "new" price without seriously antagonizing the operative. When, however, the production depends largely upon long practice of the moulder at that particular piece, or it is impossible to change or improve the method of moulding, and a direct cut is required, the duty of communicating this fact to the workman should fall to the lot of the superintendent and not to the foreman as is usually the case.

In securing a lower price by the indirect method of reducing what might be termed the moulder's cost, some general considerations should be first thought out. The production of more castings requires that the moulder must handle more iron, and this is usually the most fatiguing of his day's work. An important thing, then, is to arrange the plant and install appliances so that the iron can be gotten as cheaply, as hot and as conveniently to him from the cupola as possible. The means adopted of course, depends very largely upon the class of work, whether small or large. The shaking out, cutting of the sand, etc., can and should be accomplished with the employment of cheaper labor which, in some plants, is successfully handled on a piece-work basis.

The writer has found in a varied experience that one of the great obstacles to the reduction of prices exists in imperfections of the patterns and machines. A "rat" or a badly fitting core may often be the cause of more discouragement and dissatisfaction on the part of the moulder than a cut in wages. The moulder himself, if encouraged will often prove a valuable assistant in the devising of cheaper methods of production and, if paid cash for his successful ideas, will often call attention to possible economies in other work than that in which he is directly engaged.

Finally, the cutting of prices in the foundry should not be done in the office by officials who cannot be expected to have a knowledge of the work, methods, and processes involved, nor yet can it be well done by the foreman, whose intimate contact with the men demands that he be more or less in sympathy with them. This necessary work should form part of the duties of a superintendent or master mechanic whose chief recommendation to the position should be a thorough mechanical knowledge coupled with a sense of fairness and strength of character that will retain for him the respect of the men whether they suffer or benefit by his decisions.

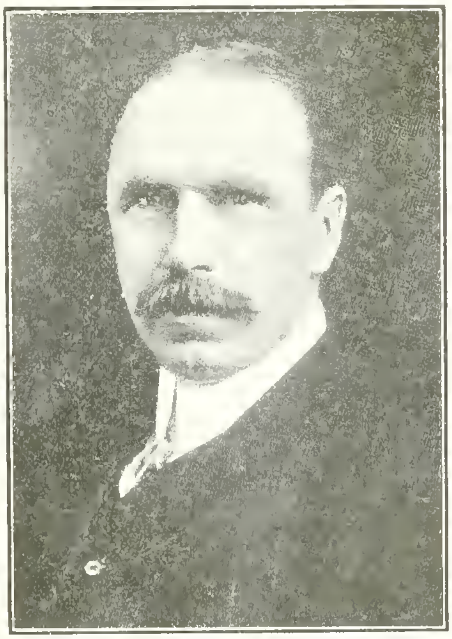
INDUSTRIAL NOTABILITIES--No. 27

W. H. CLARENDON MUSSEN, President of Mussens, Ltd., Montreal, Que., the largest dealers in railroad, contractors', mining and municipal supplies in the Dominion, and identified with many other industrial enterprises, was born April 12, 1870, in Canada's metropolis.

He is a son of Wm. Whitehead Mussen, for many years in the dry goods business, and of Georgianna Victoria (Hurlburt) Mussen, of Cobourg, Ont. The family on both maternal and paternal sides were pioneers in civic business and political affairs, and long prominent in Canada.

After leaving the Montreal High School at the age of 16, the subject of our sketch accepted a minor position with the old established firm of Cooper Fairman & Co., railway supplies, etc., at Montreal, and finally became traveling salesman. In 1889 the Cooper Fairman firm was changed to that of James Cooper.

In 1901 Mr Mussen decided to embark in business on his own account, and on June 15 of that year, established the firm of W. H. C. Mussen & Company. In 1906, the change of name to Mussens, Limited, took place, and he became president and general manager. The firm deals in railroad, contractors', mining and municipal supplies, and is the most important in these lines in Canada, having branches and warehouses located at Toronto, Cobalt, Winnipeg, Calgary and Vancouver.



W H CLARENDON MUSSEN.

Mr. Mussen is a director of Marsh & Henthorn, Ltd., Belleville, Ont.; a director of The Meaford Wheelbarrow Co., Meaford, Ont.; a director of the Ideal Concrete Machinery Co., London, Ont., and other enterprises.

He is greatly interested in club and athletic life, and is a past president of Montreal Thistle Curling Club; a past president Lachine Boating and Canoeing Club; a member of Montreal Curling Club, Montreal Jockey Club, St. James Club, Engineers Club, Canada Club, Royal Montreal Golf Club, Beaconsfield Golf Club, Country Club, Royal St. Lawrence Yacht Club, Montreal Amateur Athletic Association, St. George's Snow Shoe Club, Automobile Club of Canada, Canadian Society of Civil Engineers, Canadian Manufacturers Association and Montreal Board of Trade.

Mr. Mussen, whose residence is in Montreal, was married on April 28th, 1903, to Mima Linton Sharpe, daughter of Edward Shaw Sharpe of Montreal, and they have one daughter, Mary Eddeline Mussen.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3	19 50	20 00
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3	19 50	20 00
Clarence, No. 3	19 50	20 00
Jarrow	.....	23 50
Glengarnock	......	26 00
Summerlee, No. 3	22 00	.....
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1	19 00	18 35
Victoria, No. 2X	18 75	18 10
Victoria No. 2 Plain	18 50	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh	$20 00
Open hearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	24 00
Wire rods, Pittsburgh	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.00
Steel bars, f.o.b., Toronto	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal	2.05
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base	$2 15	
Cut nails	$2 60	2 65
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs.	$2 20	$2 20
Heads, per 100 lbs	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws	75
Plate Washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼ per lb off
Nuts, Hexagon, all sizes	4½ per lb off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright	85, 10, 7½, 10, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, bronze	70, 10, 7½, 10 p.c. off

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in.	75%
Finished Nuts over 1 in.	72%
Semi-Fin. Nuts up to 1 in.	72%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	12 00	12.00
New brass clippings	8 50	8 75
No. 1 brass turnings	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$. 32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	.....	...	.....
10 in	3.50	....	.....	...	.....
10 in	4.12	....	.....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Gal.	Lapweld Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload	$16 00	$15 75
Electrolytic copper	15 50	15 25
Casting copper	15 00	15 00
Spelter	5 25	5 25
Tin	40 50	41 00
Lead	5 00	5 30
Antimony	8 50	8 50
Aluminum	21 00	19 00

SHEETS.

	Montreal.	Toronto.
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4.30	4.10
Queen's Head, 28 B.W.G.	4.40	4.20
Fleur-de-Lis, B.W.G.	4.20	4.20
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.20	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal.	0.22
Pure turpentine	0.69
Linseed oil, raw	0.60
Linseed oil, boiled	0.63
Plaster of Paris, per bbl	2.50
Plumbers' Oakum, per 100 lbs.	5.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., March 23, 1914.—Although stockbrokers like it to be thought that the rise and fall of the stock market provides an infallible barometer by which to judge trade conditions, such is not always the case. Just at present trade is not so bad as the price of stocks would seem to indicate, and a gradual improvement is noticeable in most lines. This does not hold good of metals, however, the pig iron market in particular being very dull.

The coming summer will see considerable development in industrial circles in Montreal. Mr. M. J. Butler returned from England to-day and stated that the large plant of Armstrong, Whitworth & Co., of Canada, across the St. Lawrence at Longueuil, would be put into operation at the earliest possible date. The actual date really depends on the various firms who are supplying the equipment, but it is expected that the shops will be opened about the end of June or early in July. Most of the equipment is being purchased in Canada, a good example, which is not being followed by the Canadian Vickers Company. The latter are bringing over practically all their machinery from England.

The Vickers plant at Maisonneuve is rapidly assuming a more finished appearance. The pile-driving is nearly completed, and most of the shops have been erected. Then, too, the new mill of the Canadian Rolling Mills, Ltd., will be completed early in the coming summer.

Another large factory now going up is that of the Northern Electric Co. This will have a floor area of no less than 1,000,000 square feet when it is eventually completed, though the section now being built is only half this size.

There is a movement on foot to ask the Government to enlarge the old Tate dry dock, now operated by the Montreal Dry Docks & Ship Repairing Co., Ltd. Lake vessels of large size can at present be docked only in the "Duke of Connaught" floating dry dock of the Vickers Co. The cost of operating this dock makes its charges for accommodation somewhat higher than lake vessels are inclined to pay; hence the Montreal Board of Trade would like to see the Government enlarge the Tate dock so that it would take any vessel capable of passing through the Welland Canal. The Montreal Dry Docks and Shipbuilding Co. are quite willing to pay interest on the cost of the work, and it is hoped that the project will go through.

Toronto, Ont., March 24, 1914.—The general conditions of the market remain substantially as reported last week; the volume of business has not shown any perceptible increase and the conditions governing the situation have not changed. Perhaps the most interesting feature to be noted since our last report has been the annual statement issued by the Canadian General Electric Co., Ltd., which may be regarded as being very satisfactory considering the conditions which prevailed during the latter months of 1913. The amount of work on hand at the end of last year was considerably more than at the end of the previous year, although some of this increase may be accounted for by the taking over of two other plants during 1913. The satisfactory results obtained by the company, whose policy is distinctly conservative, should instil a feeling of confidence among manufacturers during the coming season. Last week the Polson Iron Works received an order for a large car ferry, and this together with other work on hand will keep the company busy throughout the year.

In the machine tool business the volume of trade seems to be steadily increasing and dealers are becoming more optimistic. Orders being booked are more numerous and inquiries are coming in steadily, although to small specifications. The present uncertainty regarding the outcome of the financial requirements of the C.N.R. and the G.T.P., is having some considerable effect, but if these roads are successful in their appeals for funds it will have a beneficial effect on the tool and equipment business generally.

Prices for structural steel remain firm and conditions generally are quiet. We understand that the mills are endeavoring to force prices up but in the present state of the market it is doubtful if they will be successful. The market is quiet in the United States, but an improvement may be expected next month. With the return of favorable weather and the resumption of building operations there will no doubt be a buying movement, although perhaps only of a temporary character, with a permanent improvement later in the year.

Pig iron remains quiet, the demand being for small tonnages only. Only two Canadian furnaces are producing at the present time which indicates the low level demand reached. The recent order placed with the Dominion Steel Corporation by a Philadelphia firm, is an encouraging sign for Canadian concerns.

In the metal market, prices remain stationary with a fair amount of business.

Winnipeg, Man., March 21, 1914.—During the last few weeks there has been a marked improvement in the machine tool business, coming principally from small shops recently opened in the country. The custom is to erect a machine shop and garage combined in country towns, and these usually require drill, lathes, gas engine, etc., the cost of the equipment ranging from $800 to $3,000. Large manufacturers are not buying except in cases where they are in need of a particular machine.

The City of Calgary is at present in the market for about $10,000 worth of wood and iron machine tools for their municipal shops.

The Riverside Lumber Co. of Calgary, who are building additions to their

plant, are also buying a large amount of woodworking machinery.

Henry Birks & Sons, one of the largest firms of jewelry manufacturers in Canada, who recently took over the business of Porte & Markle, Ltd., contemplate erecting a large plant here, and will no doubt buy a considerable quantity of machinery. The supply business has been fair right along, and has really been the salvation of the machine tool dealers this winter.

St. John, N.B., March 21, 1914.—The plan to develop electric power at Meductic, on the St. John River, is to be brought before the Legislature at Fredericton this week, and it is probable that then the whole future of the project will be decided. The plan of the St. John River Hydro-Electric Co. would involve ultimately an expenditure of $3,650,000. The dam at Meductic would be twenty-five feet high from low water. The river here is between 700 and 800 feet in width. The amount cited in the foregoing would include the transmission line from Meductic to St. John, estimated at about 80 miles, together with transmission lines to Fredericton and Marysville and other stations. The initial development would be about $2,600,000, and other installations would raise the expenditure to the amount named. Manufacturers in St. John and other centres are greatly interested in the scheme to have power developed and delivered at a cost lower than formerly.

The steel work on the new post office in St. John will be completed shortly. The new grain conveyors to berths No. 5 and 6 at West St. John are about finished, and the gallery department staff of the John S. Metcalfe Co. are making preparations to send the plant back to Montreal.

Another new industry has been established in St. John, a large up-to-date plant for the production of aerated waters. The company operating the factory is known as the Blue Ribbon Beverage Co., under which they are registered at Ottawa. The new concern is in reality a large branch of the business of Hamm Bros., biscuit manufacturers, and they have erected their plant in Elm Street, north end. The new factory is already fitted with modern mechanical equipment. It is a large and well-planned building.

CANADIAN TRADE.

FIGURES of Canadian trade for the month of February, just issued by the Trade and Commerce Department, show a marked falling off in both imports and exports. The decrease in imports is no less than $14,401,754, or over twenty-five per cent. The decrease in exports of Canadian products, as compared with February of last year, is $2,304,080, or about ten per cent. This is the largest decrease in both imports and exports which has been reported for years, and is a significant commentary on the continued process of trade restriction which developed last year. Imports for the month totaled $38,550,045, as compared with $52,951,809 for February of last year. Exports of Canadian products totaled $20,553,087, as compared with $22,857,167.

Figures for Twelve Months.

For the twelve months ending with February, imports totaled $632,831,746, a decrease, as compared with the preceding twelve months, of $27,617,552. Exports for the twelve months totaled $463,626,532, an increase of $96,528,033. Exports of agricultural products increased by $66,000,000, and exports of manufactured goods increased by nearly $14,000,000. The total trade of the Dominion, including coin and bullion, for the twelve months was $125,833,306, an increase of $76,276,202, as compared with the preceding twelve months.

Trade Gossip

Laying Off Men. — Twenty men employed in the Michigan Central Railway yards at St. Thomas, Ont., were laid off indefinitely on Saturday last. The reason given was that economy had been ordered from headquarters.

The Dominion Machinery Co., of 249 Victoria St., have moved their office to 82 Adelaide St. East., Toronto, where they carry a large stock of transmission equipment, also a number of hydro electric motors from 1 to 30 h.p.

Norton, Callard & Company, have opened an office at 4 Hospital street, Montreal, as manufacturers' agents. They represent Joseph Cookson, Ltd., Manchester, Eng., manufacturers of cotton waste, and J. H. Gautier & Co., Jersey City, N.J., manufacturers of gas retorts, etc.

The Dominion Machinery Co., 82 Adelaide street, east, have been appointed agents for the Frankfort furnace, manufactured by Strong, Carlisle & Hammond, Co., Cleveland, Ohio, and for the "Corona" high speed ball bearing drill, manufactured by Wright & Wood, Ltd., Halifax, Eng.

Peebles Motor Converters for Canada. —Bruce Peebles & Co., of Edinburgh, Scotland, have just received the following orders for their well-known motor converters (Peebles-laCour patents):—Armstrong, Whitworth & Co., Ltd., Longueuil, Que., two 350 k.w. sets; Canada Cement Co., one 250 k.w. set. The Armstrong, Whitworth order includes various switch gear, etc.

Business Absorption.—The business of the Tungstolier Co. of Canada has been taken over by the Canadian General Electric Co., Ltd., Toronto, etc. It is the intention to carry in stock a large assortment of electric fixtures for both commercial and residential lighting, and the Canadian General Electric Co. being equipped with an up-to-date fixture factory, will be able to give the very best service in this respect.

Westinghouse, Church, Kerr & Co., Montreal and New York, have been retained by the Canadian Pacific Railway as engineers to investigate the matter of the proposed electrification of the new double-track, 5½-mile Selkirk tunnel, in British Columbia. The investigations will cover in general the particular system to be installed, the relative economies of steam and water power, and the effect of the electrification upon operating conditions.

The Smart Turner Machine Co., Hamilton, Ont., have recently supplied the following equipment: The Deloro Mining and Reduction Co., Deloro, Ont., power vacuum pump; the Great Lakes Dredging Co., Port Arthur, Ont., vacuum pump; W. H. Batt, Charlottetown, P.E.I., combined air and circulating pump; the Western Construction Co., Courtright, Ont., centrifugal pump; Barfelt & Co., London, Ont., centrifugal pump; the Canada Sugar Refining Co., Montreal, duplex pump; the Goderich Lumber and Milling Co., Goderich, Ont., duplex pump; the Hinde & Dauch Paper Co., Toronto, triplex power pump.

Stamping Wheel Tires—Now that tires for the wheels of locomotives and other railway rolling stock are turned out in much larger numbers than was formerly the case, the old method of putting the necessary mark on by hand has become too slow an operation for modern requirements. A method of stamping at one operation by hydraulic pressure has been tried, but the continuous pressure necessary has been found to distort the tires. To overcome these difficulties, the Kalker, Werkzeugmaschinenfabrik, Breuer, Schumacher & Co., of Kalk, Cologne, have recently brought out a special steam tire-stamping hammer, which is operated by a single lever, and, it is claimed, enables the tires to be stamped both rapidly and effectively.

HEATING BUILDINGS USING CENTRAL STATION CURRENT.

By William Kavanagh.

THE installation of an electrically operated vacuum pump in conjunction with the heating system of a modern building using central station current for power and lighting purposes will lessen fuel expenses incurred during the heating season of each year.

The Vacuum System.

The most economical system of heating is known as the "vacuum system." Its installation involves the maximum cost, but its operation will be found to reduce heating expenses 25 per cent. over that of other known methods of steam heating. When the vacuum system of heating is properly installed, it will require the least amount of attention, and cost for maintenance will be reduced to the lowest possible degree. The employment of the electrically driven vacuum pump places the most economical system of heating within the range of any building not so equipped. The electrically operated vacuum pump has the great advantage of not requiring steam pressure for its operation, hence it can be seen that the pressure carried on the boilers may be reduced to that of the atmosphere; a desideratum tending towards economy of fuel.

Steam at atmospheric pressure has a sensible heat temperature of 212 degs. F., and a latent head capacity of 966 degs. F., therefore the total heat in 1 lb. of steam at atmospheric pressure will equal 1178 degs. F. If our system of heating is such as to rapidly convey away the water of condensation, and assuming the temperature of the returned water at 200 degs. F., then the total extraction of heat from 1 lb. of steam will equal 987 degs. F. From this we learn that all of the latent heat has become sensible heat by reason of condensation, and its useful effect has been realized in the heating of the building employing the vacuum method of heat circulation. In order to obtain such economy, it is absolutely necessary to have the radiators and piping free of air and water of condensation, but such a condition can only be had when the vacuum pump is employed.

Buildings equipped with the single and double pipe systems, warm air and forced circulation of hot water cannot approach in the matter of fuel economy those having the vacuum system installed. Incidentally, it should be mentioned that the attachment of the electrically operated vacuum pump to the pipe systems above mentioned will convert them into that of the vacuum system, involving only slight changes in the piping.

Vacuum System Advantages.

The vacuum system has many advantages over all other methods of steam heating, some of which may here be mentioned.

The low pressure carried on the boilers precludes all possibility of rupture or accident which are inherent in the systems using high pressure steam or forced water circulation.

In the vacuum system, the liability of leakage is remote; quietness of heat circulation is attained, and the heating effect is rapid, positive and equal over the entire plant. Such advantages are not within the scope of the other systems.

Miscellaneous Heating Systems.

The single pipe plan of heating is of two kinds, known as the "free" and "air valve" systems. In the free system, the air valve which is attached to the radiator is in turn connected to a pipe which is open to the atmosphere; the object being to facilitate heat circulation by permitting the entrapped air in the system together with the water of condensation to escape freely to the atmosphere. With the "closed or air valve" system, the air valve attached to the radiator is not connected to any other pipe, but is supposed to automatically perform the functions necessary to permit the steam to traverse the heater, and thus the dissipation of heat in the radiator is obtained.

The warm air system involves the use of a fan driven by some source of power. The fan discharges cool air through a bank of pipes containing steam, the warmed air being then conveyed through ducts conveniently located for the purpose of heat distribution.

Heating by means of warm water is accomplished in either one of two ways; one is known as "free circulation." With the other is that of "forced circulation." With the free circulation plan, advantage is taken of the gravity of the ascending and descending columns of water, thus obtaining an automatic circulation. With the forced circulation, a pump is used to circulate the heated water throughout the system, such circulation being continued as long as heat is required.

Heating by means of the electric current will materially reduce the cost, and more especially during the fall and spring months of each year. The electric current is extensively used for the heating of offices, baths, sleeping apartments, hospitals, etc., and when current can be obtained at a reasonably low figure, its continued use will be found to give satisfactory results owing to its adaptability to varying temperatures, non-vitiation of the atmosphere, cleanliness and simplicity of installation; all of which advantages combine to make it a superior media for the purpose.

From what has been said it can be seen that the maximum economy in the heating of a building cannot be obtained when fuel must be burned in order to force a circulation of steam through the heating system. Under the conditons where air can enter the piping and radiators and the water of condensation is not removed with sufficient rapidity, an unnecessary expenditure of fuel is required to overcome the resistance offered by the presence of these bodies. The employment of the electrically or steam driven vacuum pump eliminates such resistance and reduces the cost of fuel to the lowest possible degree.

6.235,000 TONS OF COAL MINED.

THE total tonnage of coal mined in Nova Scotia during the past year is the largest ever recorded, amounting to 6,235,000 tons as compared with 5,815,-000 tons the year before. Of this total the Dominion Coal Company produced 75 per cent., its output for the year amounting to 5,000,000 tons.

While this production exceeds that of former years, it is far from being the capacity of its collieries, as the year's output was curtailed by lack of labor and market. The two other large producers of coal in this region are the Nova Scotia Steel & Coal Co., and the Inverness Coal & Railway Co.

The following table gives a comparison of the output in tons of the principal companies operating in this district for the years 1912 and 1913:

	1912.	1913.
Dominion Coal	4,500,000	5,000,000
Nova Scotia Coal ..	850,000	850,000
Inverness Coal	300,000	300,000
Colonial Mining ...	35,000	35,000
Mackay Mining	30,000	30,000
Nor. Atlantic Coal..	100,000	
Cape Breton Coal..		20,000
Total	5,815,000	6,235,000

The North Atlantic Coal Co. does not appear as a producer in 1913, it having been added to the Dominion Coal Co.'s properties.

Overcoming Belt Troubles.—"How a central station can overcome its belt troubles," is the name of a pamphlet just published by the Cling-Surface Co., Buffalo, N.Y. The matter contained in its pages will prove of much value to the engineer of any central station where belts are used. The slack belt is strongly advocated. Pictures of various kinds of drives are shown and technical information is given descriptive of each drive.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Welland, Ont.—The Welland Machine & Foundries, Ltd., will erect an addition to its factory.

St. John, N. B.—The Canada Nail & Wire Co., Ltd., will build a factory at Coldbrook near here.

London, Ont. — The Canada Grate & Supply Co., will erect a plant to manufacture a new type of grate bar.

Owen Sound, Ont. — The Northern Bolt & Screw Co., is having plans prepared for extensions to its factory.

Duncan, B.C.—The town have purchased a site on which to build a power house. A Deisel engine will probably be installed.

Goderich, Ont.— The American Good Roads Machinery Co., will make additions to its factory, to cost about $90,000.

Hamilton, Ont.—The Chadwick Brass Co., is looking for a site to erect a three-story building with machine shop, plating rooms, etc.

Transcona, Man.—G. S Van Westrum, vice-president of the Westrumite Asphalt Paving Co., is negotiating for a site on which to erect a factory.

Ottawa, Ont.—The foundry, owned by the Alee Bros., which was destroyed by fire some weeks ago has been rebuilt, and the owners expect to commence work shortly.

Dundas, Ont. — The Refractory Ores Converters, Ltd., of which company Mr. D. M. Cameron, of Hamilton, is president, have leased an existing factory here and will start operations as soon as possible.

Chatham, Ont. — It is reported that Mr. Hees, of the Drop Forge Co., who was considering the establishing of a factory on the old Defiance Iron Works property, will go to Windsor to meet the civic authorities of that place with a view to discussing a scheme to establish his factory in that city.

St. John, N.B.—T. McAvity & Sons, Ltd., will call tenders early this year for the erection of part of a large plant which they propose building here. A site covering 22 acres has been purchased, and an industry will be established for manufacturing iron and brass goods.

Electrical

London, Ont.—The city are in the market for a considerable quantity of electrical apparatus, including transformers, meters, poles, etc., for particulars apply the Hydro-Electric Commission.

Hamilton, Ont. — George F. Webb's east end incline will be running in a few weeks, it is said, and will be started with the old machinery if the new electrical equipment is not ready by the time the roadbed is. The company will spend, it is said, in the neighborhood of of $50,000 on new electrical machinery.

London, Ont.— Work has started on the new $32,000 building next the Horton street hydro station, which is to house the machinery necessary for the converting of power for the London Street Railway Co., and the electrified London and Port Stanley. Plans have been completed and submitted to Building Inspector A. M. Piper, and the necessary permit has been issued.

Municipal

Stratford, Ont.—The city will spend $15,000 on a fire engine, ladder truck and motor chemical truck.

Watford, Sask.—The town council has engaged Engineer W. H. Thorold, Toronto, to report on the cost of a waterworks system for the town.

Transcona, Man. — The town council are considering the erection of a pumping station and reservoir. A site is being selected. W. M. Scott is the engineer.

Windsor, Ont.—The Water Board is preparing for further expansion and is contemplating the installation of a new pump to safeguard the supply in taking care of the growth in population.

Sarnia, Ont.—The town council will act as a special committee while attending the radial meeting in Ottawa this week to urge upon the Government the need of an up-to-date harbor for Sarnia.

Point Grey, B.C.—The listing of industrial sites near Eburne, with full particulars as to cost of power, water and other requisites, was decided on at a meeting of the Point Grey and Richmond Board of Trade on March 9.

Chatham, Ont.—W. T. Shannon has been elected president of the Chatham Board of Trade; D. McLauchlin, vice-president; J. W. Plewes, secretary; W. C. Armstrong, treasurer, and C. J. Cummings, assistant secretary.

Kamsack, Sask.—Chipman & Power, engineers, Toronto, have been requested by the town council to prepare contracts and call tenders for waterworks, sewage system and an electric light plant. It is estimated that the new works will cost about $130,000.

Sarnia, Ont.—Sarnia has inaugurated her publicity policy, and as a result of the first day's canvassing the committee of the Board of Trade have secured $3,000 in cash to help on the work of getting new industries, and to advertise the town.

Windsor, Ont. — On motion of Ald. Howell, the whole council was empowered to represent the city on the waterways deputation that will wait on the Dominion Government at Ottawa on March 26 and urge the development of the St. Lawrence route so that ocean-going vessels may reach the inland ports along the great lakes.

Toronto, Ont.—A special meeting of the Works Committee was held last Friday to consider the report of Commissioner Harris, who recommends a waterworks plant at Victoria Park, which will be of sufficient capacity to supply the whole city in an emergency. The filtration bed would handle 120,000,000 gallons per 24 hours and the pumping plant would give a flow of 60,000,000 gallons per 24 hours, which could be doubled by increasing the plant. The estimated cost is $6,033,700. In January, 1913, the ratepayers authorized an expenditure of $6,677,000. The surplus, $643,300, would meet debenture discount and financing.

Building Notes

Montreal, Que.—J. A. Benoit, architect, has in hand plans for a $150,000 convent school to be erected by the Catholic School Commissioners of Verdun. Another school is under contemplation by the Christian Presentation Brothers, at Lachine.

Windsor, Ont.—The Windsor Power Building Co., will erect the new factory building on Caron avenue and Sandwich

treet, at a cost of $80,000. It is expected that the Toledo Scale Co., of Detroit, will occupy part of the tructure.

Regina, Sask.—To judge from the permits issued so far this year, it appears hat no very great amount of construction is being planned at Regina just now. he value of structural work amounts to 66,750, nearly $200,000 less than for the orresponding two months of 1913.

Montreal, Que.—Three garages will be rected by the Autobus Co., each to be a hree-storey concrete structure, to cost etween $40,000 and $75,000 each. The tes are already secured or under option, ates Mr. U. H. Dandurand, but the ompany is not yet ready to announce e locations.

Welland, Ont.—A slight advance in the alue of permits for February is reported rom Welland, the figures being $14,424 s compared with $12,425 for the same onth last year. From the 1st of January the amount involved in building perations totals $20,536, which sum is even thousand dollars less than in 1913.

Redcliff, Alta.—The Spalding Co. td., of Medicine Hat, are advertising ids for the erection of a large warehouse ere. The contract will probably be let ithin a few days, and erection will be ommenced shortly thereafter. The size f the building will be 40 x 75 feet, solid rick construction, two storeys high.

Calgary, Alta.—The Gutta Percha & Rubber Co., Ltd., with headquarters in Toronto, will start within the next few weeks the erection of a fine warehouse n the north side of Eleventh avenue. The warehouse will be 50 x 120 and ither five or six storeys in height of odern, fireproof construction, and will ost between $50,000 and $60,000.

Leamington, Ont.—The plans for the roposed armory for Leamington have een received by Dr. Hillier, and call for building 85 x 185 feet, to cost in the eighborhood of $26,000, to be erected in 915, also a promise of one this year to ost $10,000. The structure will be built t the fair grounds, on the site of the resent main building, and apart from rill purposes will also be used by the gricultural Society during fair time.

Contracts Awarded

Ottawa, Ont.—The Government have warded the contract for the ice-breaker or the Department of Marine and Fisheries, to the Canadian Vickers Co., Ltd. he vessel will be built at Montreal and ill cost nearly a million dollars.

Toronto, Ont.—The Ontario Car Ferry o., has awarded a contract to the Polsons Iron Works, Ltd., for a new car ferry to run between Cobourg, Ont., and Charlotte, N.Y. The ferry will be 318 ft. long, 54 ft. beam and 20 ft. 6 in. deep from main deck.

Dominion Power & Transmission.—A contract has been awarded by the Dominion Power & Transmission Co. to the Canadian Westinghouse Co. for the supply of motors and generators for the new steam plant. The contract price was $360,000.

Sarnia, Ont.—Bids for the new waterworks system at Point Edward were accepted last Wednesday evening as follows:—Laying of pipe, McGee & McGee, of Point Edward; the Page Hersey Co., Welland, the contract for the steel pipes; Fairbanks-Morse Co., Toronto, the contract for the hydrants; and the Mueller Co., of Sarnia, the contract for the service fittings.

Port Arthur, Ont.—The Thunder Bay Contracting Co. understands that it has been awarded the contract by the Public Works Department, Ottawa, for Port Arthur breakwater extension. The work is a 2,500-foot extension from the easterly end of the present breakwater opposite the Government elevator. No statement has been issued but the contract price is believed to be around $250,000.

Refrigeration

Thorold, Ont.—Richard Thompson, of Merritton, has the contract of erecting the ice-plant for William C. Wilson & Co.

Berlin, Ont.—McCutcheon Bros., meat dealers, are having their market equipped with a 4-ton refrigerating machine, supplied by the York Manufacturing Co., York, Pa.

Gleichen, Alta.— Fire destroyed the new plant of the Pacific Cold Storage Co., recently. The loss is estimated at $17,000, of which only $5,500 is covered by insurance.

Brantford, Ont.—It is reported that a company is being formed to build and equip an artificial ice plant, with a capacity of 40 tons of ice per day and calling for an expenditure of $75,000.

Sydney, C.B.—The Board of Trade has decided to recommend a Federal subsidy for a cold storage plant to be erected in Sydney. The erection of this plant is for the convenience of fishermen operating on the coast of Cape Breton, and for general produce storage.

London, Ont.—The Carling Brewing & Malting Co. have decided to install an entirely new equipment of atmospheric ammonia condensers in connection with their present refrigerating plant. The improvement will be made by the Huetteman & Cramer Co., Detroit, Mich.

Sudbury, Ont.—The Sudbury Brewing and Malting Co. are enlarging their refrigerating plant by the addition of new double-pipe ammonia condensers, oil traps, suction and discharge lines, etc., all of which is being furnished and installed by the Huetteman & Cramer Co., Detroit, Mich.

St. Thomas, Ont.—The St. Thomas Packing Co. are adding to their plant a complete raw water ice making system of 15 tons capacity, consisting of ice making tank with coils, cans, covers, accumulator, circulating propellers, thawing apparatus, traveling hoist, filters, cold water storage tank, and a complete air plant, as well as direct expansion piping for storage rooms. All the equipment is being furnished by the Huetteman & Cramer Co., Detroit, Mich.

Windsor, Ont.—The Central Ice & Cold Storage Co. has been organized by J. W. Klingensmith and Edwin Wallace, and will build an ice factory of 50 tons daily capacity and a cold storage house with about 12,000 square feet of floor space on two floors of a building to be 80 x 150 feet, the remainder of which will be used for general storage. The contract for machinery has been let to the Canadian Ice Machine Co., representing the York Manufacturing Co., York, Pa.

Medicine Hat, Alta.—Arthur Pierson and William Davison, of the Medicine Hat Pure Ice Co., have presented to the city officials the plans for the new ice-skating and curling rink which they are to build this year. The plans for the ice plant have not yet been finished. Until these are approved the final agreement will not be signed up. The new rink will have a seating capacity of nearly 2,000, will have toilets, cloak rooms, and a cafe or tea room in connection. The building will be 112 feet x 50 feet.

Wood-Working

Markdale, Ont.—Geo. Watson, Flesherton, Ont., will erect a sash and door factory here.

Oxford, N.S.—The Oxford Furniture Co., is making additions and adding new machinery to its factory.

Sarnia, Ont.—E. C. Lawrence, who some time ago sold his interests in the Laidlaw Lumber Co., will shortly erect a large new planing mill on his property at Devine and Christina streets.

Toronto, Ont.—Fire broke out in the Eastern Avenue and St. Lawrence Street

yard of the Laidlaw Lumber Co., March 16, causing a loss of $50,000, covered by insurance, and throwing eighty-six men out of work temporarily.

Woodstock, Ont.—Building operations have started at the Canada Furniture Manufacturing Co.'s local plant. Material is being delivered on the ground now for a four-storey factory addition, 100 x 60 feet, to the present buildings, and to be used for manufacturing purposes. The addition will entail an expenditure of about $15,000, and will represent only a portion of the money to be spent on the factory improvements this year.

General Industrial

Montreal, Que.—The American Canning Co. may build a factory here.

Niagara Falls, Ont. — The Niagara Linen Co. will build a factory here.

Montreal, Que.—The Alaska Feather Bed Co., will make an addition to their factory.

St. John, N.B.—Harmon Bros., of this city, will build a factory for making aerated waters.

Drummondville, Que.—A factory to cost $120,000, will probably be built by the O. B. Shoe Co., Ltd.

New Westminster, B.C.—The St. Mungo Canning Co., will erect a large cannery here.

Hamilton, Ont.—The Standard Underground Cable Co., will erect an addition to its factory, to cost about $150,000.

Sarnia, Ont.—The Sarnia Fence Co., have decided to build a new plant at Fort William. The estimated cost is $75,900.

Toronto, Ont.—The village of Birchcliffe have decided to organize a fire brigade. Equipment costing $600 will be purchased.

Port Colborne, Ont. — The Board of Trade are negotiating with a stock food company, which desires to establish a factory here.

Montreal, Que.—The Berliner Gram-ophone Co., will probably build an extension to their factory, St. Antoine and Leonore streets.

Montreal, Que.— The Argus Fire Alarm Co., of 54 Notre Dame street, east, may erect a factory here to manufacture their fire alarms.

Lethbridge, Alta.—A disastrous fire at Magrath, Alberta, on March 17, reduced to ashes the 300,000 bushel elevator of the Pioneer Grain Co.

Dundas, Ont. — The Board of Trade have received inquiries from three firms desiring to establish industries here. No details available at present.

Regina, Sask.—Leitch Bros. will erect a flour mill having a capacity of 3,000 barrels per day. The city will give the company a site and bonus.

Montreal, Que.—The American Flexible Belt Co., of Canada, are contemplating building a factory here. The company have a capital of $75,000.

Pabos, Que.—The Dominion Government has undertaken to build a harbor for the St. Lawrence Pulp and Lumber Corporation here.

Vancouver, B.C.—The Imperial Oil Co. will build a refinery at Port Moody. Mr. R. S. Drake, Chief Constrnction Engineer of the company will be in charge of operations.

Moncton, N.B.—J. A. Marven, Ltd., biscuit manufacturers will build a new factory this year. The building will be 140 x 60 feet, and four storeys high. New machinery will be required.

Stratford, Ont.—One thousand yards of gravel has been delivered for cement work at the Morelock and Diebel factories. They will be located on Norfolk street, east of Borden street.

Gravenhurst, Ont. — Flax Towels, Limited, has been organized to put up a plant here for the purpose of manufacturing towels from flax straw. Later a linseed oil mill will be constructed, as well as an additional plant to manufacture other fabrics.

Sarnia, Ont.—Fire on March 17, totally destroyed the plant and contents of the John Goodison Thresher Co. The loss, which is covered by insurance, is in the neighborhood of $250,000.

Collingwood, Ont.—The town council are negotiating with an industrial concern now located in a city in Ontario, who will probably locate here. No details are being given out for the time being.

St. John, N.B.—The New Brunswick Packing Co., Ltd., has just been organized. The company propose to establish a pork packing plant and have already purchased five farms on which to raise hogs.

Grimsby, Ont.— Councillor Walker has been instructed to purchase fire extinguishers and place them on the hose reel immediately. This is being done under instructions from the fire underwriters.

Toronto, Ont.—On March 11, fire destroyed a building on King street, west, occupied by George A. Rudd & Co., and Robert Crean & Co. The loss is estimated at $130,000, of which $95,000 is covered by insurance.

Galt, Ont.—A. Richardson, of Toronto, has been in town promoting the Lion Silverware Co., in which a number of Toronto men are interested. The present plans are to locate their manufacturing works in Galt.

Neepawa, Man.— The Jackson Sheaf Loader & Carrier Co. may purchase the building formerly ocupied by the Neepawa Match Co. The company is capitalized at $30,000, and will manufacture Jackson's sheaf loader.

Kelowna, B.C.—W. Beaver-Jones, publicity commissioner, states that a company, with headquarters in Calgary, will build a canning factory here, and that work on the building will be commenced shortly.

Coaticook, Que.—The Neidner Co., of Malden, Mass., will build a plant here for manufacturing fire hose. The town will give the company financial assistance and cheap power. A by-law will be voted on in the near future.

Wallaceburg, Ont. — Mr. Fligg, of Lanark, Ont., has arrived in town to take charge of the Knitting Works, which resumed operations last week. New and up-to-date machinery has been installed and the old machinery discarded.

Arnprior, Ont. — The Arnprior Felt Co., now located at Galetta, will probably build a factory here. The company propose to purchase an existing factory, and make considerable extensions. The town will offer a loan and other concessions.

Welland, Ont. — The Ontario Tire & Rubber Co., has leased the vacant Beatty plant for its factory here and has purchased the necessary machinery equipment. A co-operative tire business will be carried on and the prospects for success are bright.

Victoria, B.C. — An Austrian firm which manufactures sawdust briquettes has written to the Development League requesting to be put into touch with firms who could quote them prices for sawdust to be shipped to their manufactories in Austria.

Winnipeg ,Man.—The Watkins, Medical Co. have purchased a site here, and will build a large factory for the purpose of manufacturing medicines, grocery sundries, etc. The company have branches in several large cities in the United States.

Toronto, Ont. — A building permit has been issued to Lever Bros., manufacturers of Sunlight soap, for the erection of a two-storey brick, steel and

concrete hydrogen house at their works on Eastern avenue. The new structure will cost $36,000.

Montreal, Que.—At the annual meeting of the Asbestos Corporation of Canada, Ltd., held here on March 11, S. D. Sharpe, the manager, stated that new properties were being developed and the work put on a more economical basis. New equipment may be required later.

Galt, Ont.—The Christie Lime Co., will make alterations to their plant which will entail an expenditure of upwards of ten thousand dollars. A three-storey building, 28 x 50 feet, will be erected at their siding in which heavy machinery will be installed for the crushing and grinding of lime.

Granby, B.C. — The new 2,000-ton smelter of the Granby Consolidated at Granby Bay, B.C., which was to have commenced operations last week, has been delayed owing to a breakage in the dam. The blowing in of the smelter is expected to bring much activity in the copper mining districts.

Dunnville, Ont.—The Sewsure Manufacturing Co., makers of shirts and aprons, is moving this week to Toronto. The industry, which was started in a midest way a few years ago by Robert Jackson, and is now owned by Charles M. Armstrong, has grown to considerable proportions.

Regina, Sask.—A large programme of construction has been completed by the directors of the Saskatchewan Co-operative Elevator Co., for the coming spring. Mr. Dunning states that the directors have practically decided to erect at least 25 elevators, and, if possible, to purchase already existing elevators.

Owen Sound, Ont.—The McQuay Tanning Co.. has withdrawn its application to the town for a loan of $25,000, and will go ahead and make the proposed extensions to its plant without municipal aid. They purpose doubling the capacity of their plant, which is devoted exclusively to the manufacture of high grade harness leather.

Vancouver, B.C.— Secretary Wesley A. Blair of the Board of Trade, was notified on March 13, that two directors of the Eureka Fireless Stove Co., of New York and Los Angeles were on their way to Vancouver to look over the ground and trade conditions with a view to establishing in Vancouver a factory that will employ 500 men.

St. Catharines, Ont.—A contract has been awarded by the Lord & Burnham Co., of New York, to the Samuel Austin & Son Co., of Cleveland, O., and Thorold, Ont., for the erection of their new factory building on Vine street, St. Catharines. The contract for steel work has been awarded to the Standard Steel Construction Co., of Welland.

Preston, Ont. — Kinzie & Son, manufacturers of pressed bricks, tiles, etc., have purchased sixteen acres of land from Jesse A. Witmer at Speedville, suitable for their line of business. They have moved their machinery to the new site and are preparing to meet the spring trade. They will install hydro power to operate their machinery.

New Glasgow, N.S.—The plant of the Standard Clay Products was destroyed by fire on March 12, the loss representing about $60,000. Workmen aided the firemen in fighting the fire, which started in the main building and spread rapidly. The buildings covered a large area and the blaze lit up the whole countryside. Seven years ago the plant was wiped out by a fire.

Raymond, Alta.—In order to work up an interest in sugar beet raising, the Knight Sugar Co., will offer about five hundred dollars in prizes this year. It is proposed to place it in the hands of the agricultural society, and thus get the advantage of the additional Government grant, which will amount to $1,000. This amount will probably be divided into about 100 prizes.

Fort William, Ont. — The Algoma Steam Laundry Co., Ltd., of this city, plan to double the capacity of their present plant. Tentative plans have been prepared and will be submitted at a meeting of the company to be held very shortly for ratification. If the plans meet with approval, the extensions will call for an expenditure of about $15,000, and the completion of the building by the first of June.

Chatham, Ont.—The industrial committee of the city council has several propositions on hand to bring new concerns to Chatham to locate here. Negotiations are being carried on with one outside company who are desirous of locating in the old Defiance Ironworks plant, on Lacroix street. If the proposition goes through, the city will sell the plant for $21,000, of which $1,500 will be paid down and similar payments will be made each six months.

Medicine Hat, Alta.—An industry is being established by Beggs Brothers who have recently come from Toronto, and are installing a thoroughly modern dry cleaning plant. A two-storey fireproof building has been built on Main Street near the Medicine Hat Steam Laundry and all the equipment, including "Bowser" gasoline washers, distilling apparatus, extractors and steam boards are being set up in readiness to begin work in a few days.

Brantford, Ont.—Lloyd D. Barber, architect, has returned from a visit to the mills of Tonawanda, N.Y., the object of his trip being to gain information for the Niagara Silk Mills Co., at Buffalo and Dunkirk for preparation of the plans for the mill which this company intends erecting here. It is expected that work will be started on a 165 by 52 feet three-storey factory about April 1. The company is doing a large business in the United States, and the Canadian end of it is likely to assume considerable proportions.

Cobourg, Ont.—At a special meeting of the town council, a resolution was passed approving of submitting a by-law to the electors to grant a bonus of $10,000 to a felt factory which is to locate here, operated by Messrs. Charles and John Dick. The site chosen is that of the woollen mills, formerly operated by John Dick, Ltd. The company agrees to employ fifty hands the first year on an average, and one hundred the second, third and fourth years, and two hundred hands for the five following years. They are also to have a paid-up capital of $90,000.

Brampton, Ont.—The Williams Shoe Co., Brampton, which has been carrying on business here for a number of years, closed down six weeks ago. The buildings and business have been taken over by a new company, the heaviest stockholders being John McMurchy of Brampton and S. Mullett of Orillia. The rest of the stock is being taken up by local people. The price paid for the business was $57,500. The factory will continue operations under the name of the Williams Shoe Co., and will open up again next week. One hundred and fifty hands were employed and a business of half a million dollars was transacted last year.

Sandwich, Ont. — The plans of the Canadian Alkali Co.'s $500,000 factory, which will be built in Sandwich this year, have been placed before the town council, and the usual exemptions given to new industries have been granted. The company intends to employ between 300 and 400 men at the start, and the pay roll will amount to $150,000 annually. The manufacture of caustic soda, chloride of lime, salts and other chemicals will be carried on. It is expected that the commencement of building operations will induce local capitalists to invest in workmen's dwellings, which are badly needed.

Sherbrooke, Que.—The Brompton Pulp and Paper Co. will erect a new paper mill at East Angus for the purpose of manufacturing news-paper. The contract was awarded for the machinery to the J. H. Horne & Sons Co., of Lawrence, Mass.,

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Maybe you have your plant fully covered as regards loss by fire.

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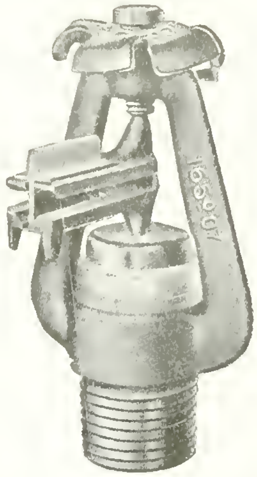

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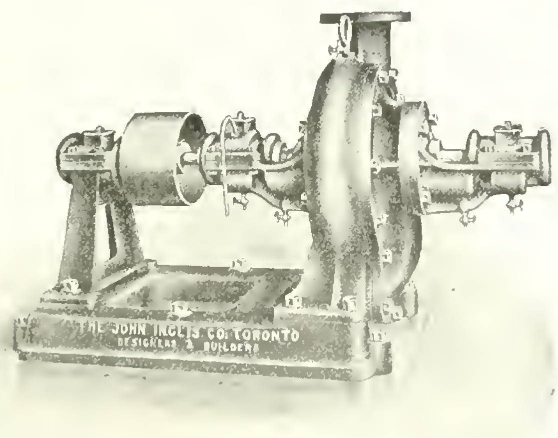


Horizontal Belt-Driven Turbine Pump

Supplied University of Toronto

This pump is hydraulically balanced against end thrust and in addition has a water-cooled thrust bearing. Side covers are arranged so that internal inspection is possible without breaking pipe joints.

The John Inglis Company, Limited
ENGINEERS AND BOILERMAKERS

14 Strachan Avenue, Toronto, Canada

Montreal Office: Room 509 Canadian Express Building

at a meeting of the directors held in the city. The new building, which will be located on the west side of the river St. Francis, is to be 72 feet by 444 in length, two storeys high, of concrete, brick and steel with a concrete roof. The power house adjoining will be 52 feet by 108 feet, and power to the extent of 1,000 horse power will be developed. The work on the building will begin at once, and it is expected that the Company will begin to turn out paper from the new mill about the first of October.

Arnprior, Ont.—At a meeting of the Arnprior Board of Trade last week a committee comprising Messrs. S. R. Rudd, Thos. Moran, E. D. Osborne and J. C. Williams was appointed to look into the proposition of the Arnprior Felt Co., whose plant is now at Galetta. We learn that in return for a loan of $10,000 for ten years, payable in annual instalments without interest and exemption from all but school taxes for the same time, they promise to purchase the shirt factory property and rebuild a three-storey brick factory; install machinery to the value of from $10,000 to $15,000; pay wages to the amount of $10,000 the first year and at least $15,000 during each of the nine subsequent years; employ 30 hands first year and from 40 to 50 afterwards, the town to be guaranteed by mortgage and insurance on building and plant.

Railways—Bridges

Berlin, Ont.—An important change is soon to be made on the Galt and Elmira branches of the Grand Trunk Railway out of Berlin, by which gas-electric radial cars will supplant the steam lines.

Lethbridge, Alta.—"We have ordered the steel, and will call tenders for the construction of the 13th street subway in a very few days," said D. C. Coleman, superintendent of the Alberta Division of the C.P.R., when he passed through the city on March 7.

Islington, Ont.—A new bridge is to be erected over a tributary of the Humber at Thistletown. Engineer Barber was instructed to prepare plans for the structure. It will be of concrete and steel construction, and will cost $3,900. Tenders for the construction will be called at next meeting.

Montreal, Que.—A budget calling for an expenditure of about $2,000,000 during the present year, on improvements of the service is being prepared by the Montreal Tramways Co., and will provide for the laying of new tracks, erection of two new car barns, and the purchase of one hundred new double truck cars.

Guelph, Ont.—Ald. Hannigan will call a meeting of the railways and manufactures committee of the city council to consider the building of a hydro-electric railway to Hillsburg, Erin and Orangeville. Between this territory and Guelph there was formerly close connection, but the Credit Valley branch of the C.P.R. diverted traffic to Toronto.

Montreal, Que.—At a meeting of the directors of Toronto Terminal Co., William Wainwright, of the Grand Trunk, was elected president, and David McNicoll, of the C.P.R., vice-president. Henry Phillips, secretary of the Grand Trunk Pacific, was appointed secretary, J. G. Suckling of the C.P.R., Toronto, treasurer, and Mr. Ardley, of the G. T. R., auditor.

Galt, Ont. — George Mountain, chief engineer of the Dominion Railway Board, after inspecting the L. E. & N. crossing on the East River road below Galt, which the North Dumfries Council protested as being dangerous, ordered that an electric signal bell be placed at the crossing, the road south of the crossing be widened, and that the Grand Valley Railway raise its tracks to the level of the approach to the L. E. & N. crossing.

Vancouver, B.C.—The Burrard Inlet Tunnel & Bridge Co., have decided to call tenders for the construction of the Second Narrows Bridge. The undertaking will cost about $2,540,000, and it is estimated that it will take about two years to complete. As an encouragement to finish the work quickly, $200 bonus per day is offered for every day the work is finished under the time limit, and a penalty of $200 a day for every day past the time limit will be levied.

St. Thomas, Ont.—St. Thomas, Aylmer, Yarmouth and Malahide having decided to secure independent estimates of the cost of building a radial line east of St. Thomas before going on with the proposal to guarantee $300,000 bonds of the London & Lake Erie Railway & Transportation Co., directors of the latter announce that they have withdrawn the proposal for the present, but will consider a new proposal when the municipalities are ready.

Vancouver, B.C.—Twenty million dollars, exclusive of terminal expenditures in this city, is approximately the amount of money the Canadian Pacific Railway will spend in the West this year, according to Mr. J. G. Sullivan, chief engineer. Most of the money appropriated to carry out this year's improvement programme will be expended in British Columbia, finishing the double-tracking operations. In addition, the company has about six hundred miles of new line to construct on the prairies. While there will be a large expenditure on construction, the heavy cost will be for rails and new ties.

Personal

W. Millar has been appointed Canadian manager of George Anderson Co., of Montreal, makers of stone-cutting machinery.

Vincent Simpson, of Gerald Lomer Ltd., Montreal, is now in the West on a business trip. He will visit the principal cities.

David Keay McLaren died at his residence 419 Mount Pleasant avenue, Montreal, on March 18, aged 78. Mr. McLaren was the head of D. K. McLaren, Ltd., belting manufacturers.

Edmund B. Temple, C. E., who retired a year ago from his position as harbormaster at Port Arthur, died at his residence in Toronto, in his 77th year. He was formerly a government engineer in the latter city. He was born in Quebec.

James Cornelius Sullivan, harbormaster of the city of Quebec, and well known to shipping and railway men all over eastern Canada and the transatlantic route, died on March 23. He had been harbor-master sixteen years, and succeeded his father in the position.

Charles T. Lamb, for many years assistant treasurer and office manager of F. E. Reed Co., Worcester, Mass., manufacturer of the well-known "Reed" lathes, and for the past two years office manager for Reed-Prentice Company, will resign on May 1st, 1914. Mr. Lamb will engage in other business.

William Apps, who, twelve years ago was master car builder for the Canadian Pacific Railway in Montreal, died from heart failure at his late residence, 98 Forest Hill Road, on Saturday last, in his sixty-seventh year. He had been living retired in Toronto for the past twelve years, and had been ill for three months.

Concerning the Lathe Work Feature in Patternmaking

By W. J. Horner

The writer first refers to the special nature of the patternmaker's lathe as distinct from that of the metal turner and even of that of the general wood turner, and then proceeds to discuss a number of practical considerations relative to the lathe equipment for holding the work, the preparation of the latter, and the various tools and their application in order to obtain the desired finished product.

IN the construction of foundry patterns there is a considerable amount of turned work. In some shops a professional woodturner does this, but as a rule the patternmaker does his own turning. In any case, the turning is so important a part of the trade and so inseparable from the bench work that it is done in the pattern-room, and a room that has not at least two lathes is poorly equipped for pattern work. Some patterns are done entirely in the lathe after the preliminary preparation of the wood at the bench; others have either the main portions or small portions turned. In a few cases there may be nothing circular or cylindrical about a pattern, and, consequently, no turning. Often the turned portions consist only of core prints, which are very common, as round holes for bolts and for other purposes are often wanted in castings. Turned bosses and facings are also common on patterns, which otherwise are made at the bench. Sometimes lathe work can be avoided by making plain circular parts at the bench, but turning is generally preferable, and even in the simplest patterns is occasionally unavoidable.

The lathes used by patternmakers differ from those used by metal turners, and to some extent also modern specialization has made slight differences between patternmakers' lathes and those used for other classes of wood-turning. The patternmaker does more face-plate work than the general woodturner, and some of this is very large in diameter. Occasionally very great lengths and diameters between centres are turned; consequently lathes of large capacity are necessary, except in some few shops where work is uniformly small and medium in size. In no case can the work of a pattern-room be properly done in one lathe, because of the great variations in the size of work, some of which would be too large to go into a small lathe and some too small to be chucked and operated on conveniently in a large one. Besides this question of size, there is the consideration in all but the very smallest shops that, with only one lathe available, the work would be hindered through some men having to wait while the lathe was being used by others.

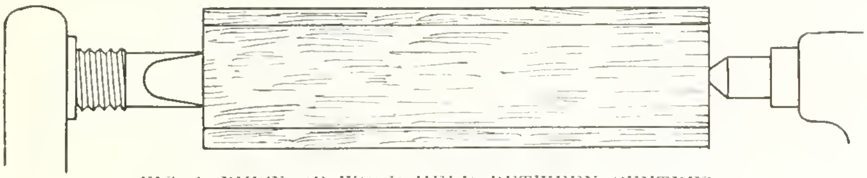


FIG. 1. PIECE OF WOOD HELD BETWEEN CENTRES.

Holding Work in the Lathe.

The way in which a piece of wood or of built-up work is secured in the lathe for turning depends on its proportions and the direction of its grain. If it be long compared with its diameter, it goes between centres, as in Fig. 1. If shorter, and if it be desirable to have its end free so that the tools can be used there, it is driven into the cup chuck or bell chuck, Fig. 2. If large in diameter and thin, and, consequently, having the grain running the other way, it is screwed to the face-plate, Fig. 3.

Fig. 4 shows the chucks separately. The fork centre being small, usually screws into the mandrel nose. The others screw on its outside. The fork centre is simply forced into the end of the piece of wood to be turned, and so compels it to revolve with the lathe spindle. At the other end the wood is supported by a plain dead centre and revolves on it, a few drops of oil being applied at starting to reduce friction. The point of the centre enters the wood about 1/8 in. to 1/4 in. A centre hole is generally bored with a bradawl in each end of the wood before putting it in the lathe. When dealing with hard wood, a slot about 1/4 in. deep by 1/8 in. or a little more in width is generally sawn across one end to facilitate the entry of the fork centre. The angles are pared or sawn from the piece of wood before putting it in the lathe. If it were turned down from the square it would dull the tools needlessly and be a loss rather than a saving of time.

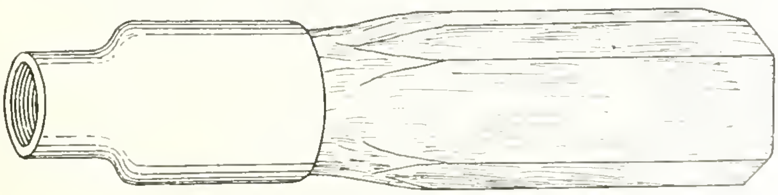


FIG. 2. PIECE OF WOOD IN CUP CHUCK.

The piece of wood in the rough should be two or three inches longer than the finished work to allow for cutting down at the ends. Between centres the turning cannot be carried completely to the axial line, but the work when otherwise finished must be taken out of the lathe and have the rough ends sawn off and the article finished by paring its ends with a chisel. It is here that the cup chuck method, Fig. 2, has some advantage over the between-centre method. It allows the outer end of the wood to be recessed or turned to any shape, and then the article can be cut off with a chisel while the lathe is running. Long pieces of wood do not run steadily enough at the outer end when held only in the cup chuck. Occasionally it is convenient to use it instead of a fork centre and bring the dead centre of the poppet up to steady and support the other end. The end of the wood is simply driven a tight fit into the cup chuck, being either pared with a chisel

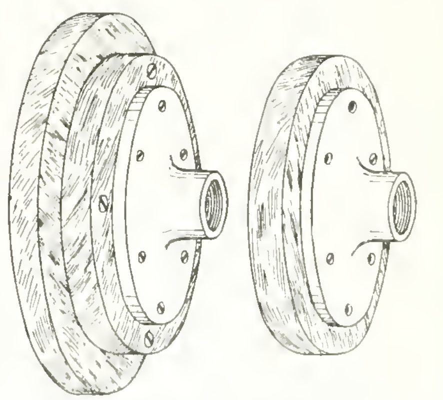


FIG. 3. PIECES OF WOOD SCREWED TO FACE PLATES.

before insertion or put between centres and turned to fit the chuck.

Face-plates.

Woodturners' lathes are provided with metal face-plates of different diameters, with countersunk holes for screws, by means of which the wood is held to the plate, Fig. 3. Generally, and invariably in large work, a wood plate larger in diameter than the metal is screwed to the latter, and the actual work is screwed to the wood plate, as in the example to the right in Fig. 3. The advantages of this are that the work can be screwed at points far outside the diameter of the metal plate, and that the wood surface can be recessed if necessary to suit the work or have pencil circles marked to set the work by. Also, the cutting tools can be used right up to the surface of the plate without risk of injury to them, and so rechucking is seldom necessary.

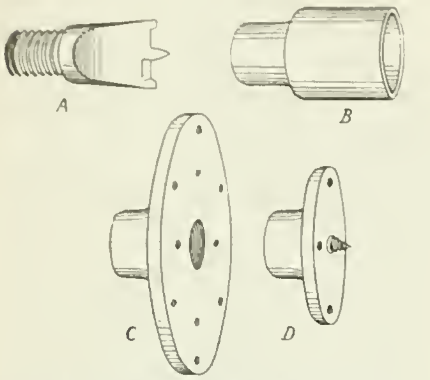


FIG. 4. CHUCKS USED IN WOOD-TURNING: A, FORK CENTRE; B, CUP CHUCK; C, ORDINARY FACE PLATE; D, PLATE WITH TAPER SCREW FOR SMALL WORK.

Small plates for ordinary work consist of single pieces of wood, while large ones are built up, as in Fig. 5. A metal plate of such a diameter would be very heavy, and would not be so convenient for the rechucking and attachment of work; there is also the risk of injury to the tools when they have to cut close up to the surface of the plate. Most pattern work of large diameter is in the form of rings of various cross sections, which could not be screwed to a small plate. Screws are always used in preference to the methods of the metal turner. Small metal face-plates often have a taper centre screw solid on their face, as shown at (D) in Fig. 4. A piece of wood with a small hole bored in the centre can be screwed on to this, and is held securely enough if small, or a larger piece can have two or more screws put through the plate into it in addition.

Such plates are generally not fitted with a supplementary wood plate, but are used for the attachment of work direct, which is usually held only by the central gimlet-shaped screw. Plates without this screw are bored right through for the mandrel nose, as at (C), Fig. 4, and when a wood plate is put on them, a screw hole can be bored through the centre of it for small work, for which a screw in the centre only is sufficient to hold it for turning. Screw holes in work are as a rule not objectionable. Sometimes they are plugged after the work is finished, but frequently they are covered in fitting parts together, or sometimes can be utilized for permanent screws.

A considerable amount of work is glued to the plate instead of being screwed, the only objection to it being delay while the glue is drying. The wood is not glued direct, but with paper between. This holds securely, and when the work is finished it is prized off the plate with a chisel without injury either to work or plate. The glue does not lose its hold, but the paper splits and can be cleaned off after. All wood turned on the face-plate is sawn circular with an allowance for turning. A great deal has to be built up in segments. Wood plates

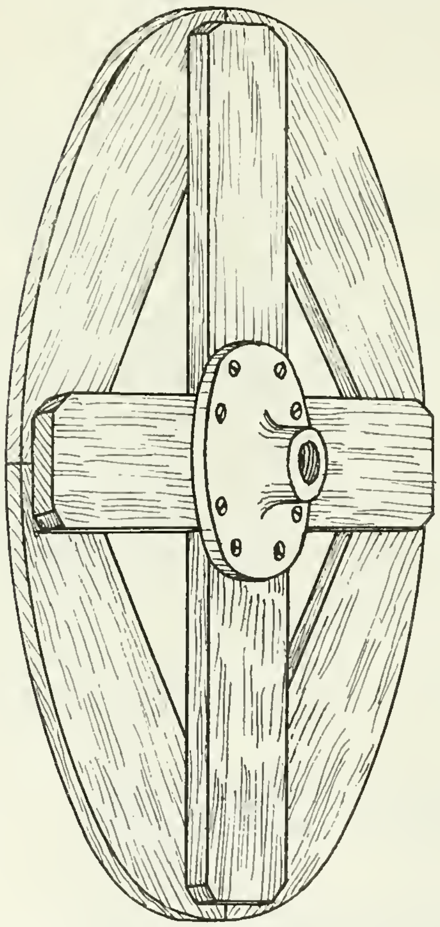


FIG. 5. FACE PLATE FOR WORK OF LARGE DIAMETER.

are trued up when they require it. Large ones are reduced as little as possible, and, when work has to be rechucked on them, it is done by putting on temporary pieces rather than turning a recess in the face and so spoiling it for other work. Small plates, being easily renewed, are recessed or reduced in diameter or modified in any way that happens to suit the work.

In screwing work to a plate, the screws are nearly always put through from the back, and are of a length which involves

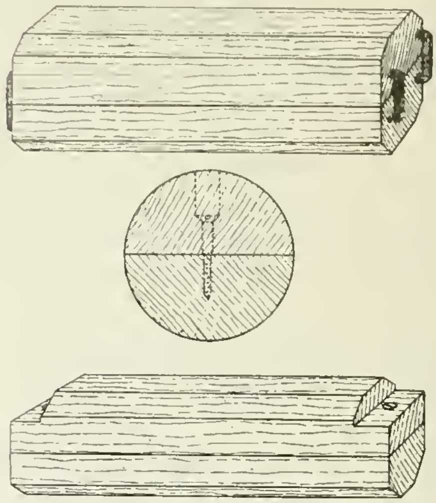


FIG. 6. METHODS OF USING STAPLES AND SCREWS FOR HOLDING WORK WHICH HAS TO BE TURNED.

no risk of their points being reached by the cutting tools. Some of the screw holes in the metal plate are occupied by screws, which hold it to the wood plate, but usually there are enough holes to allow some vacant ones for use if wanted for holding the work. Besides these, holes can be bored through the wood plate anywhere outside the diameter of the metal one. Wood plates may range in diameter from only slightly larger than the metal up to the largest that will swing over the lathe bed, while metal plates are always much smaller than the lathe capacity. Sometimes it is more convenient to screw work to the plate from the front. This can be done when screw holes are wanted through the piece of wood being turned, and when there is little or nothing to face off the front. Thus, thin pieces of wood are often planed to thickness and put in the lathe only to have their edges turned. In such cases they are often held by nails instead of screws, and are lifted off with a chisel when finished, or the nails may be only partly driven in and pulled out with pincers.

Work Turned in Halves.

A large proportion of pattern turning has to be in halves for convenience of moulding. Work can be turned solid and sawn through the middle afterwards, but for several reasons this is not satisfactory, and is seldom done, jointing before turning being preferred. Figs. 6 and 7 show ways of temporarily holding the halves together when such turning has to be done between centres. In Fig. 6 the upper example shows

halves held by staples or dogs. In large work these are used in addition to other means, and may occur along the sides as well as at the ends, being shifted and replaced as the turning proceeds. A stronger way is to screw the halves together with screws sunk low enough not to interfere with the turning. Screws at intermediate points in a long length must go into countersunk holes, as in the middle view, Fig. 6. At the ends it is generally better simply to notch out, as in the lower view. In any of these cases the lathe centres have to be adjusted as nearly as possible on the joint line. In screwing up, there is some tendency to force the joint open, and there is the probability of one or both ends getting more or less out of centre in relation to the joint, giving unequal halves.

For these reasons, centre plates, Fig. 7, are used for all heavy work in halves, and often for solid heavy pieces between centres. These are usually of metal, about 1/4 in. thick, with four screw holes for screwing them to the ends of the wood. One plate has a slot for the fork centre, while the other has a countersunk hole to fit the dead centre. In large work, screws or staples may be used in addition to centre plates.

Another kind of centre plate for light work is not screwed on, but has points or prongs so that it can be hammered on and holds like a staple. When the work is screwed up between centres it is impossible for it to come loose, but absolute accuracy of adjustment in putting on the centre plates is not easy.

Work on the face-plate also has sometimes to be turned in halves, though not quite so frequently as that between centres. This, however, only means that each half must be screwed on with the joint across the centre of the plate. Such work nearly always consists of flanges, bosses, large prints, and other fittings to be attached to a larger pattern, as a

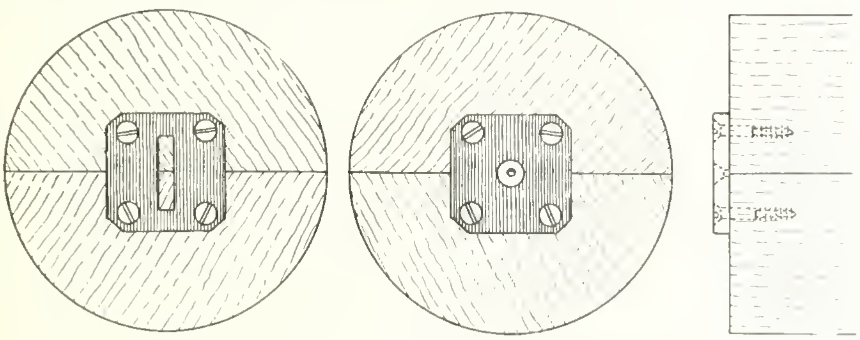


FIG. 7. HALVES HELD TOGETHER BY CENTRE PLATES SCREWED TO THE ENDS

complete pattern turned on a face-plate would usually be moulded on its flat, and, therefore, would not be wanted in halves.

Tools and Methods of Working.

The tools used are not numerous compared with those required for bench work. The usual turning tools are shown in Fig. 8, but some of these are kept in different sizes to suit large and small jobs. The turning gouge is the

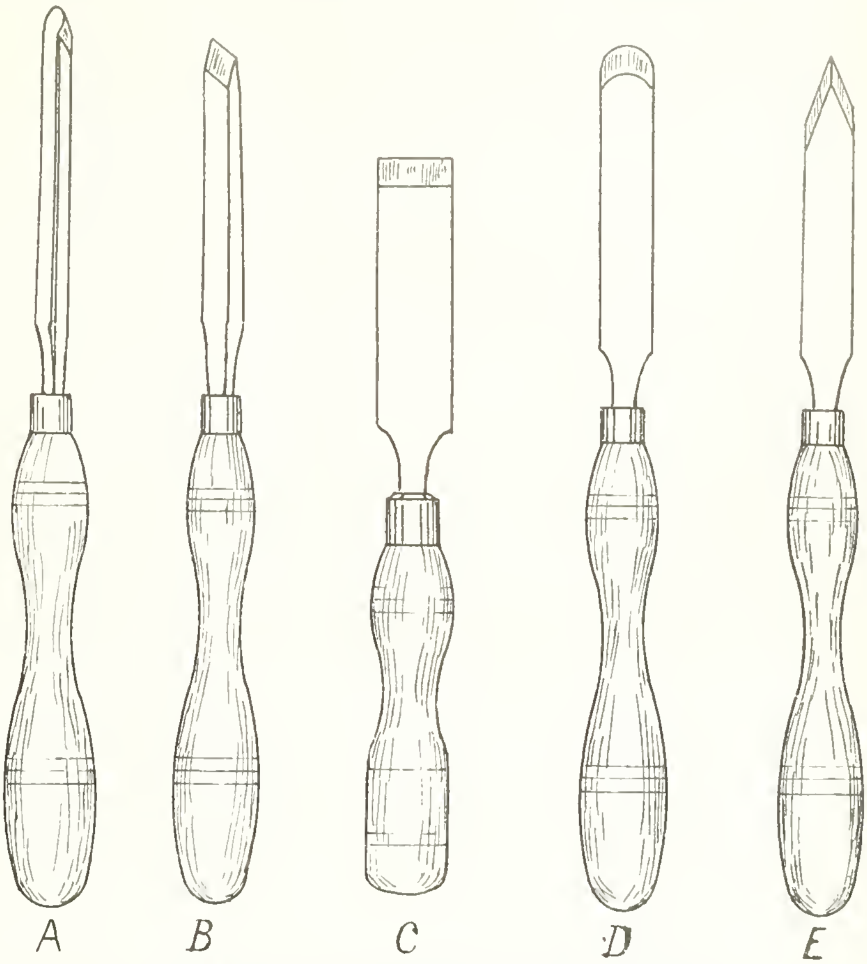


FIG. 8. CUTTING TOOLS USED IN WOOD TURNING

A, Gouge, B, side chisel; C, facing chisel, D, round nose E, diamond point

most important tool, and is the only one used exclusively for cutting as distinguished from scraping. It reduces nearly to size, and then other tools remove the gouge marks and impart a smooth finish.

The side chisel is used after the gouge on work between centres chiefly. It may be tilted to take a diagonal shearing cut, or used on edge for parting, or on its flat for scraping. It is ground on both sides. The firmer or facing chisel scrapes straight portions between centres or flat ones on the face-plate. The round-nose scrapes concavities. Convex portions are scraped with a chisel. The diamond-point scrapes right or left hand in places where a square-fronted chisel would not work. Sometimes separate right and left-hand tools are used instead of a diamond-point.

Calipers and rule are used for measurement. Dividers and trammels are often used for marking lengths between centres or diameters on the face-plate, usually when a number are wanted alike. Otherwise such measurements are taken direct with a rule. Templets often have to be made to serve as guides for getting the correct shape. The patternmaker usually works from drawing, and his work differs from ordinary woodturning in having to be precise, accurate to size, curves to a definite radius, and straight parts absolutely straight or flat, with little or nothing that is ornamental or can have its contour judged by the eye alone. Moreover, there is very little repetition, and, consequently, standard templets or patterns to work from cannot be kept.

Templets are required chiefly for curves. They are cut from thin wood or thick paper, very often from glass paper,

a radius being struck with dividers, which cut through the paper, and so provide a templet instantly. Sometimes the templet is more complicated, but generally rule or calipers can be used for parts adjoining the curve. There are also cases where the curve is a complex one, having more than one radius, and not easily tested with separate templets for each radius.

Straight edges or the edges of steel squares are used, the same as in bench work, for testing the straightness of parts and as an assistance in measuring depths. Work for which templets are necessary is drawn full size in section on a board, and the templets tried on this before being used. This is chiefly in face-plate work, and in this also it is almost invariably necessary to build the work in segments or short arcs of circles glued up in layers with overlapping joints, to form a ring of the size and shape required. This is a question of jointing rather than of lathe work, and sometimes has to be done in work that is not turned.

QUITS PARTY ON IMPLEMENT DUTY QUESTION.

"I AM unalterably out of the Liberal party because I feel that the policy they are supporting is detrimental to the interests of a business in which I am not only deeply concerned, but in which I have a great human interest. I have stated the policy that I believe to be fair and just, not only to the concern in which myself and others are interested, but to the people of Canada. I intend to adhere to it, whatever other people do. I feel that the Liberal party has deserted me."

Such is the declaration made by Sir Lyman Melvin Jones, president of the Massey-Harris Co., Toronto, with repect to the endorsation by the Liberal party in the House of Commons of a resolution calling for the removal of duty from agricultural implements.

Favors Moderate Tariff.

"I will continue in the position which I have occupied for many years. I believe, as I have believed all along, that it is to the best interest of the country to raise its revenue by a moderate tariff, and not by direct taxation or a high tariff. I was born a Liberal, and while I do not pretend or boast about my political qualifications, I feel that I have always tried to act in the best interests of the people.

"I have never requested or desired a high protective tariff. I am not a free trader, and I do not approve of Canada raising its revenue by direct taxation. My opposition to such a policy is due to the fact that taking into consideration the existing relations between Canada and the United States, such an innovation would be impossible. I feel that if I adhered to the policy advocated by the Liberal Opposition it would ultimately prove disastrous to one of the greatest industries in Canada.

A Compromise Suggested.

"In my opinion it is one of the most absurd, ridiculous and unbusinesslike policies that has ever been brought up in Parliament. It is lamentable for many reasons, and I feel that the masses and a great many farmers really do not understand the absurdity of the issue. For many years the farm implement industry has been made the scapegoat. Had the party proposed a reduction of duty on subsidiary articles, such as steel, iron, bolts, nuts, and other things pertaining to the industry, which we are obliged to import, I certainly would have supported a plan calling for a slight reduction on farm implements generally."

In support of his contentions Sir Melvin Jones pointed out that when the late Government placed binder twine on the free list some years ago the industry was eventually annihilated in Ontario.

Sir Melvin states that he has not been interested in the binder twine industry for ten or twelve years, and that he made the comparison merely to demontrate that if the same treatment was accorded the farm implement industry in Canada it would ultimately disorganize and disrupt manufacturing interests that had played a prominent part in the developing of the great western prairies.

Looks for Better Times.

Briefly referring to the money stringency in Canada during the past couple of years, Sir Melvin pointed out that while the activity in the farm implement industry had not been as marked as five years ago, he was sufficiently optimistic to harbor a feeling that it would only be a matter of a short time before it would recover its normal place as of yore.

"I have watched the growth of the West from its infancy," concluded Sir Melvin, "and my whole life work has been devoted to helping to build it up. While the firm with which I am connected have helped the settlers to develop their homesteads, credit must also be given the merchant, the blacksmith and others who helped to shoulder the burdens of the new citizens."

A WASTE OF MONEY.

"IT would be an absolute waste of money to deepen the St. Lawrence River just because the Welland Canal is being deepened," said Sir Robert Perks, the English engineer and builder of public works, who arrived in Montreal from New York, last Friday morning, in the course of a conversation on Canada's waterway requirements.

Sir Robert said he still favored the Georgian Bay-St. Lawrence Canal scheme. He said that the Welland Canal-St. Lawrence route would cost more than double that of the Georgian Bay route; it would be much longer, while it would not be wholly under the control of the Dominion.

The Welland Canal-St. Lawrence route would cost $280,000,000, Sir Robert claimed. He further said the cost of deepening the St. Lawrence River so that ocean-going steamers could use it would be as much as the whole Georgian Bay Canal scheme, while permission to do it would have to be secured from the United States. He thought the Georgian Bay Canal and the English Channel tunnel were the two great outstanding engineering tasks that should be undertaken in the near future.

TORONTO HYDRO-ELECTRIC SYSTEM.

LAST year's business brought a net surplus of $34,576 into the coffers of the Toronto Hydro-Electric System, or approximately 3 per cent. on the total investment. The gross income amounted to $1,159,339.71 for the year, while the cost of current and the expenses of operation and management, including repairs and maintenance, absorbed $681,-217.01, leaving a net balance of $478,-122.70. The interest, depreciation, and sinking funds for the year amounted to $443,546.83. These figures show that the operating expenses were reduced $5\frac{1}{2}$ per cent. from those of 1912, and the cost of current lower by 4 2-3 per cent., chiefly due to the reduced charge made by the Provincial Commission.

Notwithstanding the request of the Provincial Hydro Commission in regard to the reduction of rate, the report of the commission issued recently declares that a reduction of rates at this period in the development of the system would be unjustifiable. The statement points out that no complaint has been received from the customers relevant to the rates, but the commissioners state that whenever conditions warrant it, a reduction will be made, and say that it would be a breach of trust on the part of themselves to sanction any reduction before the financial condition of the enterprise justified it. "It is the policy of the commission to give in the first place a first-class service," reads the report, "and in the second place to give that service at the lowest cost possible. That policy will be strictly adhered to."

MACHINE SHOP METHODS AND DEVICES

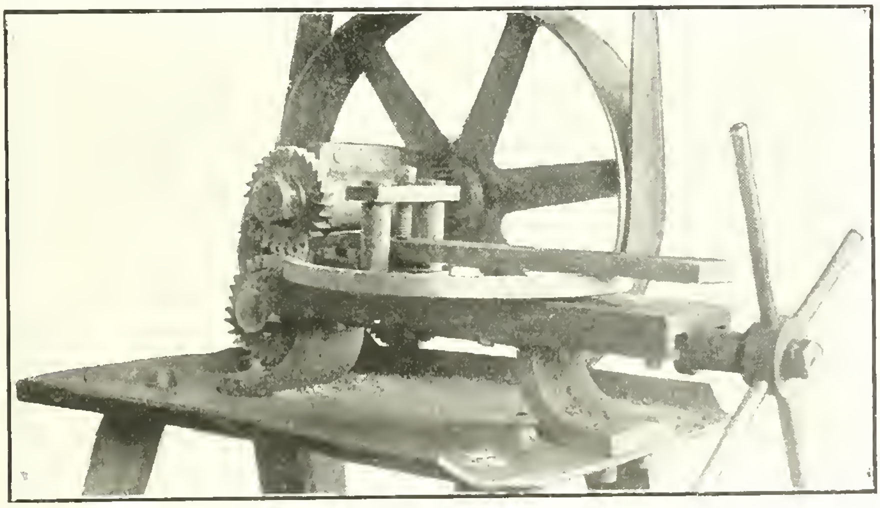
Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

SPLITTING PISTON RINGS.

D. O. Barrett.

THE photograph shows a machine for splitting piston rings where the lap point is used. This particular machine as shown is non-adjustable, the cutters being 4 inches in diameter and 9/16 inches wide. The upper cutter is placed about 3/4 in. ahead of the lower one so that their teeth will not interfere and yet both cut to the same line. Spur gears are placed on the ends of the shafts next to the pulley to drive the lower cutter, while the table slides on a portion of the main frame, which is extended back to carry the same. The nut for the screw which is operated by the hand wheel is also carried in the frame.

At the back of the sliding table under the ring will be noticed a series of stops; these are arranged both at the front and the back, the stops varying in sixteenths, with every other step marked with the number of eighths corresponding. For instance, to split a ring 5/8 inches thick, the block is slid along until the step marked (5) comes into position. The back step is then placed so that (5) comes under the ring when the split will come central. The steps are held in position by springs which clamp over each side of the table. The two posts at the front are slotted down the inside, and the long cold rolled steel bar has pins fitting these slots, which keeps it in position and prevents it from hitting the cutters. The clamp across the top is slotted so that it can be easily removed and replaced.



SPLITTING PISTON RINGS

In the particular shop in which this was used, the same split was used on all the rings, namely 9/16 in. The machine was used for sizes from 8 in. to 18 in., and saved a great amount of time over other methods of splitting. It was possible to feed the work into the cutters quite rapidly, owing to the fact that the cut was taken both above and below. Had it been necessary, it would have been possible to adjust the spindles sideways so that varying widths of cutters could have been used.

FLYWHEEL QUERY.

By N. G. Near.

CONCERNING H. Westwood's query in the March 12 issue of **Canadian** Machinery, there is not sufficient information given to arrive at a very exact or even satisfactory solution. Much depends upon the design of the flywheel—number and type of arms, manner of casting, bolting, etc.

Bearing "average" conditions in mind, however, I would say that there is practically no change in tension on the hub bolts. There should be none, for the same reason that there should be no change in tension in cylinder cover studs, which has recently been so thoroughly discussed in **Canadian Machinery.** Most of the stress, in flywheels, caused by centrifugal force, must be borne by the rim bolts; it having been shown, for example, that in some designs there is absolutely no change in stress in the flywheel arms save that due to the centrifugal force of the arm itself. Of course, there are bending stresses set up, caused by acceleration and deceleration, but these will be neglected here. We will consider centrifugal force stresses only.

Applying the old flywheel formula $P = \frac{12 W V^2}{G}$ where (P) is the tensile stress per sq. in. in the flywheel rim, (W) the weight of one cubic inch of the material of which the flywheel is made (0.26 lb for cast iron), V the velocity of the flywheel rim in ft. per sec., and $G = 32.16$ the acceleration due to gravity, we get, for Mr. Westwood's wheel 785 lb. per sq. in.

Assuming a ton to be 2,000 lbs. and, solving for the cross-sectional area of the rim, I get an area of 170 square inches. The total tension is therefore 785 lb. per sq. in. × 170 = 133, 600 pounds; the same to be held by two bolts or about 70,000 lb. per bolt, which is a whole lot more than should be allowed, inasmuch as the cross sectional area of each bolt is only about 3 sq. in., the unit stress thus being 23,000 lb. per sq. in.

I therefore contend that if Mr. Westwood's flywheel is an average design, the stress in the hub bolts will not change, whereas the stress in the rim bolts will increase about 69,000 pounds.

SQUARING ROUND HOLES.

By M. L. S.

AMONG the many little jobs of the so-called non-productive departments of our plants, the forming and fitting of hexagon, square, and other forms of sockets is often one of the most tedious and expensive. In a great many tool rooms, the process of making a drill press socket for a square shanked tap would involve first finishing the outside of the stock in the lathe and drilling a hole equal in diameter to the side of the square desired in the end. The hole would then be squared at the bench by means of chisels, drifts and files.

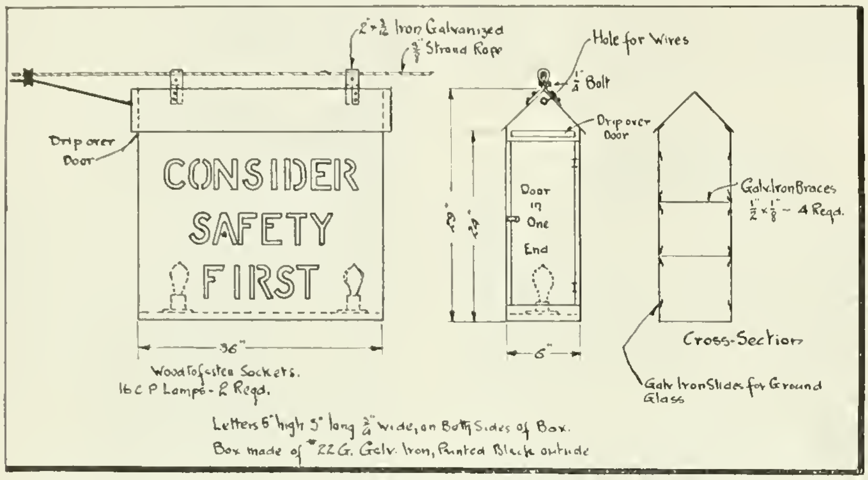
A very much better way, especially where many sockets are to be made, is to first drill the hole either in the lathe or in the vertical Vee block of the drill press and then have it drifted to the shape desired in the smithy. If this be done, by using a round nosed drift followed by one of the exact shape and size, at the proper heat and with the exercise of ordinary care on the part of the smith, a square can be secured fully as accurate and strong, and many times cheaper than by means of hand work of the average machinist.

The socket is next slipped upon a piece of square stock which has been previously trued up in the lathe chuck, the back end is centre drilled and the outside finished in the usual way.

A "SAFETY FIRST" SIGN.

By J. H. W.

THE illustration shows a "Safety First" sign used at the Montreal Rolling Mills, where it is suspended between two buildings near the entrance to the works in such a way that teamsters, and others entering the plant, cannot fail to notice it. The sign is also displayed at awkward corners, over alleyways, approaching railway sidings, and at other places of danger.



SAFETY FIRST SIGN.

The sign consists of a metal box made from galvanized sheets, 22 W.G. thick, and painted black outside. The words, "Consider Safety First" are cut out on each side in letters five inches high by three inches long by 3/4-inch wide. Each word occupies one line and is glazed with a piece of ground glass carried by light galvanized slides, as shown by the cross-section. The ground glass makes the wording very conspicuous by day, the letters contrasting strongly with the black paint. At night the sign is illuminated by two 16 c.p. lamps placed inside, the lamp sockets being screwed to a light board at the bottom of the box. The two sides of the box are braced together by four 1/2-inch by 1/8-inch galvanized iron braces, and a door is fitted at one end. The sign is suspended overhead by two light clips from a 3/8-inch galvanized wire rope, and, of course, is at a sufficient height to clear the highest load likely to enter the plant.

This device can be made up at small expense, and is very effective. It is in use at all the Montreal plants of the Steel Company of Canada, of which the Montreal Rolling Mills forms one.

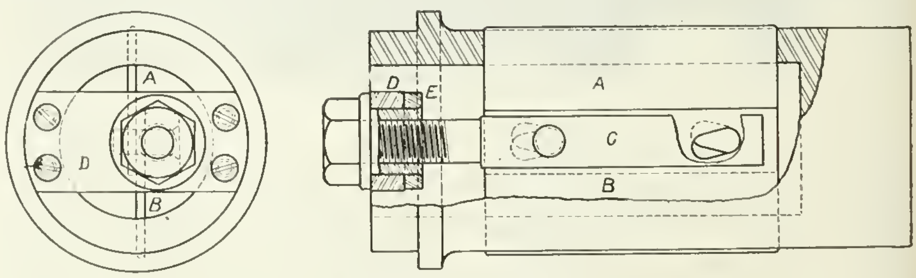
A BABBITT MANDREL.

D. O. Barrett.

HAVING a large number of removable babbitt bearings to make, the mandrel shown was devised to cast the oil grooves directly in place. These were one-eighth in. wide and about one-sixteenth in. deep. Self centering caps were used at the ends of the bearings which were cast as a complete circle and, after babbitting, split to make two halves. These are not shown. A fillet was used only on the one end.

The mandrel was bored out to the depth of the bearing, and slotted on each side with a one-eighth in. saw, the cuts being on opposite sides of the centre so that the sides of the pieces (A) and (B) would be in line. Slots three-eighth of an inch wide were milled in these pieces at an angle of 15°, and long enough to give the necessary in-and-out movement. The bar (C) was fitted with pins working in these slots and, as the bar was moved in and out, there was a corresponding movement of the pieces (A) and (B). The mandrel was milled across the end to accommodate the piece (D) in which was located the nut.

The nut was turned down and the washer (E) riveted on the end after being passed through the piece (D). This held the nut firmly in position and prevented movement in either direction



A BABBITT MANDREL.

when turned. The washer under the nut was pressed on, in order to give more bearing surface, under the nut. By turning the nut in the proper direction, the movement of the pieces (A) and (B) could easily be effected.

AN ATTACHMENT FOR THE LATHE.

D. S. Mann.

IN visiting a machine shop lately, the writer noticed a attachment on a lathe that was new to him. This lathe was used a great deal on jobs in which both boring and turning were done; such as on as small pulleys, engine crossheads, etc. A drive shaft was attached to the back of the lathe running along beneath the carriage and was driven from one of the gears at the head end. A sprocket was carried on this shaft, and was caused to slide along with the tailstock. This shaft was, of course, provided with a keyway the full length. Just inside the handwheel on the tailstock was placed another sprocket, normally loose and driven from the lower sprocket by means of a bicycle chain. One of the spokes in the handwheel had been drilled and a pin could be slipped through the same, fastening the sprocket and handwheel together when a power feed was provided. Boring bars were provided with a taper at the one end fitting the tailstock and were carried in a bushing in the spindle. These bars were slotted to carry the boring tools.

In this manner there was no connection whatever between the carriage and the boring tools, so that either could be manipulated as desired without in any way interfering with the other. Boring and turning could thus be carried on simultaneously with the proper feeds for each. To stop the boring operation, the pin in the handwheel was simply pulled out, and if this attachment were not to be used for some time, the gears were also disconnected.

BORING TOOLS.

By H. Womersley.

BORING bars and heads, like many other tools may be made in endless variety and must be suited to the work in hand. We give herewith a description of a pair of boring tools that, while

not new to some readers, still involve several novel features. Figure 1 represents the tool holding feature of a heavy boring bar. The tool (T) may be of any size or section desired and is held firmly in place by means of the plate (P) and the studs (SS). The slot for the tool may be easily machined in the shaper or otherwise, which, for large tools, obviates a very tedious operation.

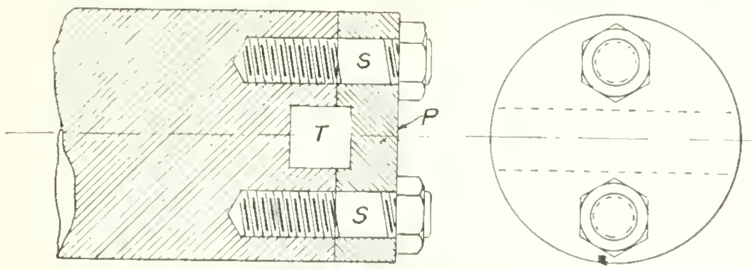


FIG. 1. BORING TOOLS

In Fig. 2 is shown a boring head which may be attached to any style of shank desired. The four tools (T) are carried by slots in the head (H) and are fastened by means of the set screws shown. It wil be noticed that the tools are not placed in a common plane but are staggered so that each one will do a certain portion of the cutting. This device may be used for roughing by setting the tools at different distances from the centre, or may be used for finishing by grinding all the cutters to an equal radius.

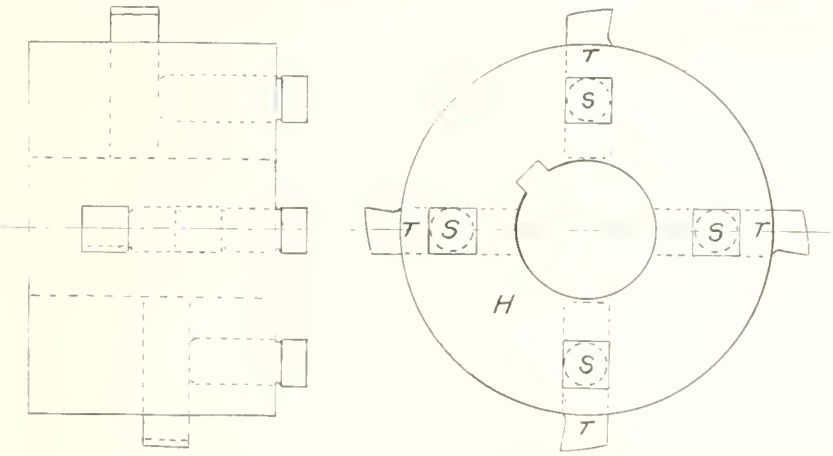


FIG. 2. BORING TOOLS.

Editorial Note.—If the tools (T) were set with the cutting sides radial, the necessity of grinding them on top could be practically dispensed with.

FLYWHEEL KEYS.

D. S. Mann.

A MANUFACTURER building a line of oil engines used a flywheel key similar to that shown in the drawing. Strictly speaking, it consists of two keys, both tapering but with the tapers turned in opposite directions to make the two sides parallel. The taper is about one-eighth inch in six inches of length. Oil engines are subjected to frequent and quite violent pre-ignitions, often sufficient to crack the hubs of the flywheels. The side (a) of the one key is left dry, and is inserted in the wheel with the small end projecting about three-fourths of an inch, sufficiently to get at for driving in. The other side is then oiled as well as both sides of the second key, which is then driven in. This half is driven in with a sledge, the width being such that it will drive up to a little more than an inch. No fit is attempted at the top or bottom.

In removing the keys, the one-half is driven in, and is released by the taper. Great care must be exercised to get the keyways in both the wheel and shaft exactly the same width as otherwise the key is apt to exert a greater force on the hub then on the shaft, which is liable to result in a cracked hub.

FLYWHEEL KEYS.

Calgary, Alta.—A proposition is being considered by the city to erect an industrial building for the accommodation of small manufacturers desiring to locate here.

CANADIAN GENERAL ELECTRIC REPORT.

THE profit and loss account of the Canadian General Electric Co. for the year 1913 shows that the gross profits amounted to $2,029,898.60, as compared with $2,011,719.83, indicating an increase in business, notwithstanding the financial stringency that occurred in the country.

Out of the gross profits for the year the sum of $470,933.98 was applied to depreciation and $222,654.69 for interest, leaving the net profits for the year $1,336,309.93. From this dividends on the preferred stock and bonus on the common stock took $776,634.17, leaving surplus earnings for the year of $559,675.76.

Reserve Amount Increased.

Of this surplus, $328,134.05 was added to the reserve fund and $231,541.71 to the balance of the profit and loss account. As the balance at the credit of this profit and loss at the end of 1912 stood at $682,390.63, it had increased at the end of 1913 with the amount carried to it to $913,932.34.

The reserve fund now amounts to $2,700,000, and this with the amount standing at the credit of profit and loss made the total surplus at the end of 1913 $3,613,932.34, equal to 36 per cent. of the par value of the share capital of both common and preference. There has also been accumulated a reserve for depreciation now amounting to $1,537,605.42.

In connection with the inventory, the directors' report states that, following the policy of the company, this has been taken at cost or market value, whichever was the lower. Ample reductions have been made for depreciation, and any obsolete stock has been written down to scrap value.

Real Estate Advanced.

The real estate owned by the company has advanced in value since the date of purchase, but has been carried on in the books at the original purchase price. The services of the Canadian Appraisal Co. were obtained in 1913, to make a complete itemized appraisal, and the report shows the replacement value of the real estate, plant and equipment to be $3,200,000 in excess of the book values. From this amount they have deducted $1,271,685, leaving an excess value of $1,928,315.

In the previous year the company, under the headings of "patents" and "contracts," in its balance sheet, showed the item of $503,761.42, being their book value after depreciation had been written off from year to year. Included in this were the goodwill, the company's own patents, and the contracts and trade marks, which were

used in the conduct of the business. These being of intangible value, have been written down to the nominal sum of $1, thus increasing the value of the real estate by the amount written off patents and contracts, and allowing the balance of excess of the value of real estate, plant and equipment, amounting to $1,424,554.58 to remain as an inactive reserve.

ONTARIO'S OCEAN PORT.

ANY suspicion that Moose Harbor, on James Bay, could not become a great seaport was dispelled by Mr. J. G. G. Kerry, consulting engineer of the T. & N. O. Railway, in an interesting and illuminating address at the Science Building, Toronto, on March 26. Mr. Kerry submitted a number of facts concerning the position and nature of this harbor, to which the Government Railway is to be extended.

Need of Northern Development.

"Information as to the design of a great terminal is not complete, and much has yet to be secured before the design can be worked out without alteration." Mr. Kerry took the view that New Ontario, an unsettled district between two more settled portions of the Dominion, was the cause of a distinct east and a distinct west.

"The settlement and development of this portion is the most important national work now in progress in Canada," said the speaker. "The establishment of a commercial centre will assist greatly in the development. Moose Harbor is well located." Mr. Kerry pointed out its proximity to Toronto, Winnipeg, Montreal, and other large centres, adding that it was but twenty-four hours' run from Toronto.

Easy to Make a Harbor.

Referring particularly to Moose Harbor, the speaker said that the tides did not appreciably affect it, and that the average low tide depth was from 15 to 20 feet.

"The most serious proposition is the bar at the river mouth," continued Mr. Kerry. "My personal opinion is that if a channel be dredged it will be found that it will remain open. There is not sufficient silt in the river discharge to fill it in. It is not wise to look for an enormous growth in traffic at first, and a depth of 15 feet in the channel over the bar at low tide will be sufficient now, and more can be done as the traffic grows."

Season of Fair Length.

The length of the navigation season at Moose Harbor was only one month shorter than the season in Montreal, and ran from five and a half to six months, and this could be lengthened by the use of icebreakers. The Moose River went out with tremendous ice crushes in the spring, but these, under conditions very similar, have been mastered in Montreal and could be there.

Mr. Kerry estimated that 1,000 feet of crib wharf could be put in at a cost of from $125,000 to $150,000, and that a 15-foot depth channel could be dredged through the bar for from $500,000 to $600,000, making a harbor to start with, to be enlarged if traffic demanded.

ICE INFLUENCE ON WATER-POWER DEVELOPMENTS.

IT has been confidently predicted by a well-known engineer that at no distant date Canada will have not only transcontinental railways, but a transcontinental water-power system.

If this prophecy be ever fulfilled—and it would appear to be on the way—its realization will be in a large measure due to the work of men like Prof. H. T. Barnes, of McGill University, who gave a lecture last week, at the Engineers' Club, Toronto, on "The Influence of Ice on Water-power Developments."

Dr. Barnes is more or less of a theorist, and conducts his experiments chiefly from a scientific point of view, but his theories have proved very valuable in practice, and have been carried into effect in practical commercial undertakings. Mr. Murphy, of Ottawa, has admitted that some of the best results from experiments he has made in connection with power houses in winter have been based upon Dr. Barnes' theories.

The "Frazil" Trouble.

The problem which Dr. Barnes is at present engaged upon, and which he expounded by means of limelight illustrations, is to keep the great northern waterways open in the winter months. He showed by many photographs of ice formation in rivers and rapids how power plants were hampered by the accumulation of "frazil." This "frazil" is a formation which gathers in large, sponge-like masses in the beds of rivers, and rising to the surface, forces the upper ice above the water, and causes packing. Dr. Barnes' experiments included the idea of diagonal booms above the dam, and the forcing of hot air or steam on the surface of the water at the head of the dam.

He criticized the Government's handling of ice-breaking on the St. Lawrence River, and said that the Government thought they knew everything about ice-breaking. He declared that the present ice-breakers were useless, and that the Government had given an order for a new one to a firm that had never made an ice-breaker before.

CANADIAN FAIRBANKS-MORSE REPORT.

THE reactionary trend of business through 1913 is reflected in a marked degree in the annual statement of the Canadian Fairbanks-Morse Co., Ltd., which shows net profits of $224,792 against $390,303 in 1912, a decline of $165,511, or about 42 per cent.

Despite the sharp falling, the company was able to pay the regular 6 per cent. dividend on $1,500,000 of preferred stock, and the regular 8 per cent. dividend of $1,600,000 of common, and still have something to the good. The margin, however, was a small one, $6,792, as compared with $213,190 the previous year, surplus earnings available for common stock dividend working out to only 8.4 per cent. against 21.3 per cent. the previous year.

Although the company again demonstrates a strong position in the balance sheet, the business operations were naturally affected by the strain imposed by the financial stringency on all industrials, particularly those with important Western connections. A new item of $780,133 appears in current liabilities under the head of "bank and other loans," while current assets rose $176,324 to $3,902,901 last year. Current liabilities rose from $675,500 to $1,483,494. At the end of 1913 the excess of current assets over current liabilities was $2,419,407, against $2,918,583 at the end of 1912.

Passed Through Trying Year.

Mr. H. J. Fuller, president of the company, deals frankly with the situation in his annual report. "The conditions existing throughout Canada during the year 1913," says Mr. Fuller, "were very different from those of 1912. Whereas our facilities during 1912 were taxed to their utmost, which meant that the volume of business available was all we could take care of, it has only been with the greatest difficulty during 1913 that we have been able to equal the same volume. To do this has entailed increased expenses, and the increased competition and decline on values of raw materials and finished goods has slightly decreased our percentage of gross profit. These two items taken together account for the difference in profits as shown between this year and last."

Sanguine as to the Future.

Concluding, Mr. Fuller states: "The situation in Canada resulting from an over-exploitation of lands and real estate has reacted to a healthy basis, and although we shall undoubtedly go through a trying period of readjustment, yet with the easing of the money situation and the constant immigration there is no question as to the future of the country or of the share which this company will enjoy of its prosperity."

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Attention is drawn to the alternating course in arithmetic, a concurrent study of which is recommended with that of the Question and Answer Series.

Question.—A vertical steel rod, $1\frac{1}{2}$ inches in diameter, has a weight of 35,340 lbs. suspended from its lower end. What is the stress per square inch of cross-section of the rod?

Answer.—Find the area of the cross-section of the rod, and divide the load by this area. Thus:

$$\text{Area} = \frac{3.1416 \times 1.5 \times 1.5}{4} = 1.767 \text{ sq. in.}$$

$$\text{Stress} = \frac{35340}{1.767} = 20{,}000 \text{ lbs. per sq. in.}$$

* * *

Question.—A hoisting drum is three feet in diameter. How many revolutions will it make in winding up 100 feet of rope. The drum is to be considered as being wide enough to take all the rope in one layer—no overlapping.

Answer.—The drum in one revolution winds up

$3.1416 \times 3 = 9.4248$ ft. of rope,

therefore, to wind up 100 feet it must make

$$\frac{100}{9.4248} = 10.6 \text{ revolutions.}$$

* * *

Question.—A locomotive has driving wheels 66 inches in diameter. If the wheels slip 22 revolutions per mile, how many revolutions do they actually make in four minutes when running at thirty miles per hour?

Answer.—At 30 miles per hour, the distance covered in four minutes is:

$$\frac{30 \times 4}{60} = 2 \text{ miles.}$$

In two miles there are 10,560 feet, and the number of revolutions made by the 66-inch ($5\frac{1}{2}$ feet) wheels in this distance, including slippage, is

$$\frac{10560 \text{ ft.}}{3.1416 \times 5.5 \text{ ft.}} + (2 \times 22 \text{ revs.}) = 655.18$$

revolutions.

* * *

Question.—A railroad car wheel, 42 inches in diameter, is found to be three pounds out of balance at a radius of 18 inches. What will be the "hammer blow" on the rail at every revolution when running at 30 miles per hour?

Answer.—There are 5,280 feet in one mile, and the number of revolutions made in one mile by a 42-inch ($3\frac{1}{2}$-feet) wheel is

$$\frac{5280}{3.1416 \times 3.5} = 480 \text{ rev. per mile.}$$

The car travels one mile in two minutes, and therefore the revolutions in one second are

$$\frac{480}{2 \times 60} = 4 \text{ revs. per second.}$$

The hammer blow on the rail will be the centrifugal force of the unbalanced weight, and this centrifugal force (F) is expressed by the formula:

$$F = \frac{Wv^2}{gR}, \text{ where}$$

F=the centrifugal force in lbs.

W=the unbalanced weight in lbs.

v=the velocity of the revolving unbalanced weight in feet per second.

R=the radius (in feet) of the path in which W travels, =1.5 feet.

g=acceleration due to gravity, =32.2.

The only one of the above factors not yet known is the velocity (v), but since the wheel makes 4 revs. per second,

$v = 3.1416 \times 3 \text{ ft.} \times 4 = 37.7$ ft. per second.

Then the hammer blow on the rail is

$$\frac{3 \times 37.7 \times 37.7}{32.2 \times 1.5} = 88.27 \text{ lbs.}$$

* * *

Question.—Find the weight of a hollow cast iron cylinder 30 inches long, 18 inches outside diameter and 14 inches inside diameter. Cast iron weighs 0.26 lbs. per cubic inch.

Answer.—To find the number of cubic inches of metal in the cylinder, subtract the inside area of the cylinder from the outside area, and multiply the result by the length of the cylinder. Take all dimensions in inches and the result will be in cubic inches. Next multiply the cubic inches by 0.26, and the answer will be the weightof the cylinder in pounds.

Area of 18 inches $= .7854 \times 18 \times 18 = 254.47$ sq. inches.

Area of 14 inches $= .7854 \times 14 \times 14 = 153.93$ sq. inches.

Weight of cylinder is

$(254.47 - 153.93) \times 30 \times .26 = 784.2$ lbs.

* * *

Question.—How many Imperial gallons of water are contained in a rectangular tank, 6 feet long by 4 feet wide by 8 feet deep? One Imperial gallon occupies a space of 0.16 cubic feet.

Answer.—The cubic contents of the tank are

$6 \times 4 \times 8 = 192$ cubic feet,

$$\text{therefore contents} = \frac{192}{0.16} = 1{,}200 \text{ gals.}$$

* * *

Question.—A cylindrical welded steel tank, open at the top, is made of $\frac{1}{4}$-inch plate. It has an internal diameter of 36 inches and an inside depth of 5 feet. It is filled to a depth of 50 inches with sperm oil, weighing 8.81 lbs. per gallon. Steel plate weighs 0.283 lbs. per cubic inch, and one gallon occupies a space of 277,274 cubic inches, or 0.16 cubic feet. What is the combined weight of the tank and its contents?

Answer.—Since the tank is welded, there are no rivets, lap joints or angle irons to be considered. First calculate the number of cubic inches of metal in the tank. The thickness of the tank is $\frac{1}{4}$ inch; therefore, the mean diameter is $36\frac{1}{4}$ inches, and the number of cubic inches in the vertical walls of the tank is

$3.1416 \times 36.25 \times 60 \times .25 = 1708.25$ cub. ins.

To this must be added the base of the tank, or

$.7854 \times 36.5 \times 36.5 \times .25 = 261.58$ cub. ins.

The weight of the tank is therefore

$(1708.25 + 261.58) \times .283 = 557.46$ lbs.

The space occupied by the oil is

$.7854 \times 36 \times 36 \times 50 = 50894$ cub. ins.

And the number of gallons in this space is

$$\frac{50894}{277.274} = 183.5 \text{ gals.}$$

The weight of the oil is

$183.5 \times 8.81 = 1616.63$ lbs.

Then the total weight of tank and contents is

$557.46 + 1616.63 = 2174.09$ lbs.

* * *

Question.—A stationary engineer has a cylindrical oil storage tank 24 inches inside diameter. It has a flat bottom, and on measurement he finds the depth of oil remaining in the tank to be $18\frac{3}{8}$ inches. How many gallons of oil has he in the tank? Consult the previous question for the number of cubic inches in a gallon.

Answer.—The number of cubic inches of oil is

$.7854 \times 24 \times 24 \times 18.375 = 8312.66$ cub. ins.

Then, the number of gallons in the tank is

$$\frac{8312.66}{277.274} = 30 \text{ gals. (nearly).}$$

• • •

Question.—What weight can be raised by a single geared steam winch, of which the following are the particulars? It has two double acting steam cylinders, 8 inches diameter by 10 inches stroke; mean effective steam pressure in cylinders, 90 lbs. per sq. inch; number of revolutions per minute of engine shaft, 120; pinion on engine shaft, 16 teeth; gear wheel on winch 180 teeth; diameter of winding drum, 15 inches. The overall efficiency of the whole machine is 40 per cent.

Answer.—The horse-power developed by the engine is

$$\frac{2\times90\times.7854\times8\times8\times10\times240}{33{,}000\times12}=54.8 \text{ h.p.}$$

This is equal to $54.8\times33{,}000=1{,}808{,}400$ ft. lbs. of work per minute.

The gearing has a ratio of 16 teeth to 180 teeth; so the number of revolutions per minute made by the winding drum is

$$\frac{120\times16}{180} = 10.66 \text{ r.p.m.}$$

Therefore the load is raised at the rate of

$$\frac{3.1416\times15\times10.66}{12} = 41.86 \text{ ft. per min.}$$

By the "Principle of Work" the work put into a machine is equal to the work absorbed by the machine plus the work given out by the machine; and the work put in, as found above, is 1,808,400 ft.-lbs. per minute. We are told that the efficiency of the machine is 40 per cent. In other words 60 per cent. of the work put in is absorbed in overcoming friction, so the useful work got out of the machine is only

$$\frac{1{,}808{,}400\times40}{100} = 723{,}360 \text{ ft.lbs. per min.}$$

We have seen that the weight is raised at the rate of 41.86 feet per minute; therefore the weight which the winch can raise at this speed is the number of ft.-lbs. of work got out of the machine in one minute divided by the number of feet through which the weight is raised in the same time, or

$$\frac{723{,}360}{41.86} = 17{,}280 \text{ lbs.}=\text{weight raised}$$

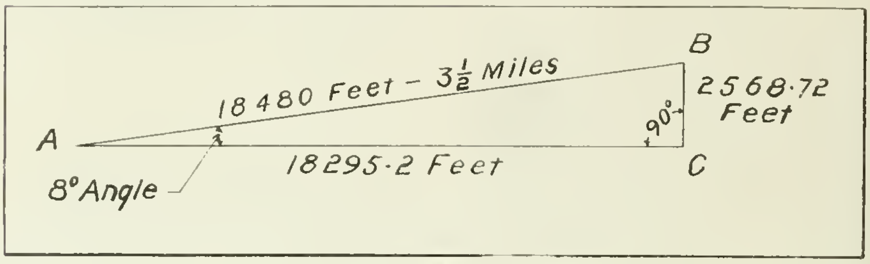
• • •

Question.—A car of 20,000 lbs. weight ascends an inclined plane of 8 degrees grade, 3½ miles long, in 15 minutes. If the friction be 3 per cent. of the load, what is the horse-power absorbed?

Answer.—Referring to the diagram herewith, let the triangle (ABC) represent the inclined plane. The angle at (A) is 8 degrees, and the distance (AB) is 3½ miles, or 18,480 feet. Now, the total work done in moving the car to the top of the incline is equal to the work done in moving it against friction through the horizontal distance (AC), plus the work done in lifting it through the vertical height (BC); consequently the first thing to do in seeking a solution is to calculate the lengths of the sides (AC) and (BC) of the triangle. Find (AC) first.

Cos. A = Cos. 8 = .99, but Cos. A $= \frac{AC}{AB}$, therefore $\frac{AC}{AB} = .99$.

AB = 18,480 feet, therefore $\frac{AC}{18{,}480} = .99$, and $AC = 18{,}480\times.99 = 18{,}295.2$ feet.



SOLUTION OF HORSE-POWER PROBLEM.

Next find the height of the side BC, $\frac{BC}{AB}$ = Sin. A = .139, therefore $\frac{BC}{18{,}480} = .139$, or $BC = 18{,}480 \times .139 = 2{,}568.72$ feet.

Now, the work done against friction is 3 per cent. of 20,000 lbs., or 600 lbs., moved through the distance (AC), or 18,295.2 feet, and this amount of work is equivalent to

$600\times18{,}295.2 = 10{,}977{,}120$ ft.-lbs.

Again the work done in lifting the car through the height (BC) is $20{,}000 \times 2{,}568.72 = 51{,}374{,}400$ ft.-lbs., therefore the total work done is $10{,}977{,}120 + 51{,}374{,}400 = 62{,}351{,}520$ ft.-lbs.

This amount of work is done in 15 minutes; therefore the work done in one minute is $\frac{62{,}351{,}520}{15} = 4{,}156{,}768$ ft.-lbs., and the horse-power exerted is

$$\frac{4{,}156{,}768}{33{,}000} = 126 \text{ h.p. (nearly).}$$

• • •

Question. — How long must a mild steel bar be so that, if lowered vertically into the sea, it would break with its own weight?

Answer.—Consider a cross section of 1 square inch. One foot of steel one inch square weighs 3.4008 pounds, and has a breaking strength of 60,000 lbs., and one foot of sea water one inch square weighs .4461 pounds. The net weight of 1 ft. of steel of 1 inch cross section when immersed is therefore, 2.9547 pounds, and the length necessary to produce a stress of 60,000 pounds would be $\frac{60000}{2.9547}$ or 20,318 feet.

• • •

Question.—The ram of a hydraulic elevator is 10 inches in diameter. The unbalanced weight of the elevator is 500 pounds. What hydrostatic pressure would be required to raise 2½ tons?

Answer.—Total pressure on ram is 5500 pounds. Area of ram cross section is 78.54 sq. ins., therefore 5500 pounds distributed over 78.54 sq. in. would require a pressure of $\frac{5500}{78.54} = 70.028$ lbs. per sq. in. or approximately 70 pounds per sq. in. in the receiver tank.

Question.—A Prony brake, with a lever arm 5 feet long was applied to a pulley running 275 revolutions per min. The lever was found to balance at 70 pounds on the scale pan. How much power did the brake absorb?

Answer.—Applying formula

$$\frac{2\Pi r\times W\times N}{33000} = \text{h.p., in which}$$

r = length of brake arm

W = weight on scale pan

N = r.p.m. of pulley, then

$$2 \times \frac{22}{7} \times \frac{5\times70\times275}{33000} = 18.66 = \text{h.p.}$$

• • •

Question.—A 48-inch cylinder is to be bored. How many revolutions per minute should the table of the mill make in order to give a cutting speed of 50 feet per minute?

Answer.—Circumference of 48-inch circle would be $48\times3.1416 = 150.7968$ inches, and number of revolutions required =

$$\frac{50\times12}{150.7968} = 3.97 \text{ or approx. 4 r.p.m.}$$

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

UNIVERSAL CAM MILLING MACHINE.

THE Rowbottom universal cam milling machine, built by the Rowbottom Machine Co., of Waterbury, Conn., has embodied in its design many original features. It is the first cam cutting machine that has the cutter head mounted on a vertical slide, and is claimed to be the only machine that will cut all styles of cams in general use without the addition of extra attachments. The advantages derived from the vertical cutter head construction are as follows:—

The roller which controls the movement of the cutter slide is held in contact with the master former by gravity, so that the cutter cannot crowd or creep away as it is liable to with the horizontal cutter slide. All chips produced in cutting fall away from the work as fast as produced. Flat master cams are used for all style cams, whether box, face, drum, or side cams. These master cams may be increased in size to ease off the working angles in cams that have steep rises; the difference between master and work being adjustable by master roll bracket. The accompanying photographs illustrate the general design, and show the arrangement for cutting the various styles of cams.

The machine is driven by single belt from a two-speed countershaft; other speed changes for work and cutter spindle being attained by change gear levers. There are four speed changes to both the cutter and work spindles controlled by gear levers and, through the medium of the two speed countershaft, make eight cutter speeds and eight speeds of feed. Both the work and cutter spindles can be run in either direction independent of each other, making it possible to use either right or left

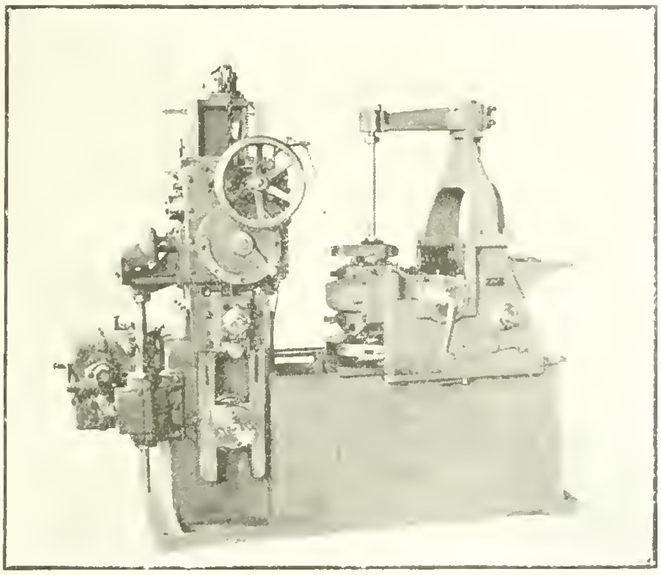


FIG. 1. UNIVERSAL CAM MILLING MACHINE.

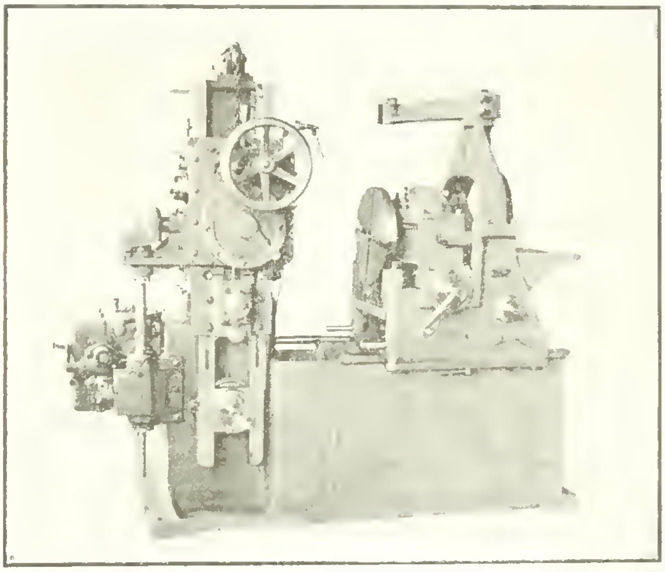


FIG. 2. UNIVERSAL CAM MILLING MACHINE.

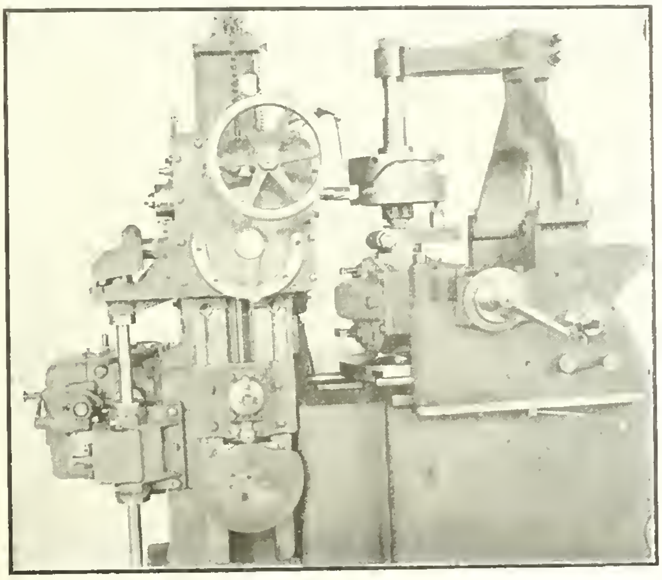


FIG. 1A. UNIVERSAL CAM MILLING MACHINE.

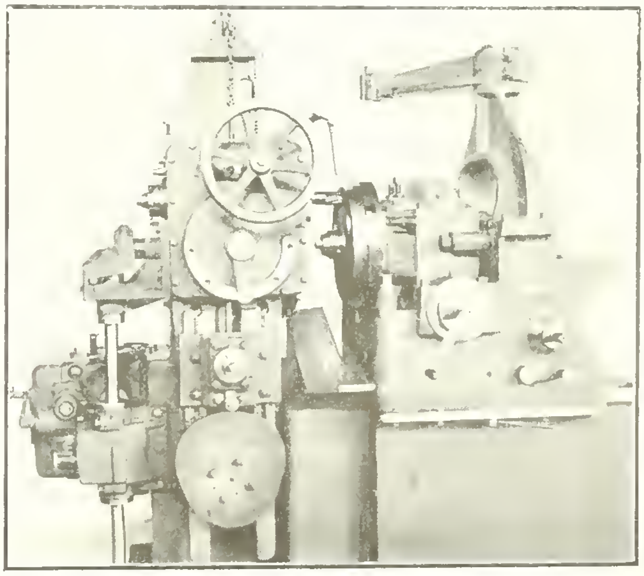


FIG. 2A. UNIVERSAL CAM MILLING MACHINE.

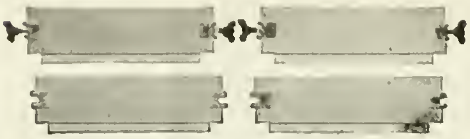
hand cutters, while the feed can be run in the direction best suited for the style of cam, or shape and angle of groove to be cut.

The cutter spindle slide operates vertically, following the shape of the master cam by its own weight, regulated by counterweights. The master cam is mounted on the end of spindle which revolves between the two extended guides of the slide, below the cutter gear box. Between the master cam and cutter gear box is an adjustable bracket carrying the follower roll of the master. This bracket is adjustable on the slide extensions and connected to the main part of slide by an adjusting screw and operated by crank handle. Through this adjustment the cutter spindle is brought to the required radius on the cam and measured off directly by the pointer and scale on the left side of cutter head and, with the micrometer dial on roll bracket, measurements to one thousandth of an inch can be attained. The slide can be raised quickly by hand wheel and held by ratchet and pawl in any position desired while changing cutters. All cutter driving gears are of steel and heat treated.

The work head has a lateral motion on the bed to and from the cutter by hand crank levers. This also is provided with micrometer dial for the direct and accurate measurement of the depth of groove to be cut. The work spindle is instantly separable from the driving mechanism and master cam, when desired to turn the work by hand for adjusting the cam blank to the most accurate position in relation to the master, it having an angular adjustment as fine as one-quarter degree of the circle.

Figs. 2 and 2A, show the machine with the work spindle parallel with the cutter spindle, and the spindle bearing bolted rigidly to the upward extension of the work head at the back. This is the arrangement for cutting face or box cams, the work being secured to the face plate, which is a solid forging with the spindle, and provided with No. 12 B & S taper hole for work arbors. The under part of face plate is provided with a bearing as shown, which adds greatly to the rigidity of the machine. There are no overhanging parts except the cutter and work which cannot be avoided.

Figs. 1 and 1A show the machine adapted for cutting cams of the drum and side type. The work spindle bearing is rotated forward on its trunnions through an angle of ninety degrees and securely bolted to the front part of the work head. This brings the axis of the work spindle vertical, presenting the other end of spindle as a working end. This end also is provided with a No. 12 B & S taper hole for arbors, and an arm to carry the driving stud. The vertical arbor is supported at the upper end by an overhanging arm which is easily detached from the arbor by a slip bushing; and then swung out of the way.

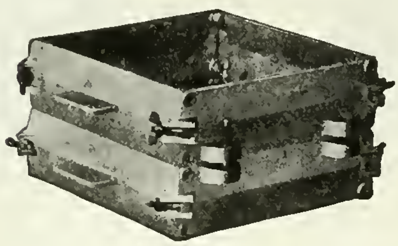


UPSET SHOWING FLANGES WITH 9 DEGREE OF TAPER.

Drawback bolts through the spindles are provided for the cutter and work arbors, and an oil tank and pump with flexible tube are supplied when desired for steel work. The weight of machine complete with countershaft is 4,500 lbs.

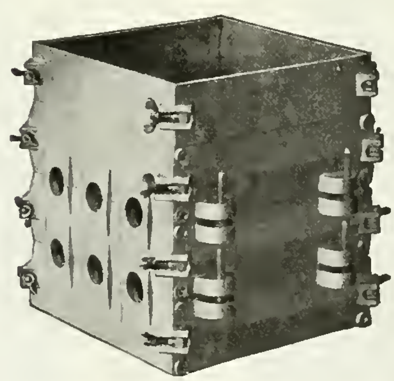
KNOCK-DOWN FOUNDRY FLASK.

DEVIATING from the beaten path of improvements in foundry equipment, the Federal Foundry Supply Co. of Cleveland, has evolved and put in the



TWO-PART FLASK WITHOUT UPSET.

market a serviceable built up flask that will, no doubt, fill a long felt want in many brass and aluminum plants. This flask known as the A and D adjustable and interchangeable tight iron flask, is made in 18 different sizes. By knocking down and making rearrangements of ends and sides, 2,187 different sizes of flasks can be produced.



THREE-PART FLASK WITH UPSET ATTACHED.

The difficulty heretofore encountered —that of fastening the elements quickly and strongly together, seems to have been satisfactorily overcome by the use of a combination of pins, swivel bolts and wing nuts. The A & D flasks are constructed of cast iron, the parts being machined with jigs and to gauges, so that, should a breakage occur, the piece may be replaced at a fraction of the cost of a complete flask. The pins, swivel bolts, etc., are made of rust and corrode-proof Aero Metal, and so attached that no parts can be mislaid or lost as would be the case with loose bolts and nuts. Cheeks and upsets are also furnished in widths of 1 in., 2 in., and 3 in., and are interchangeable with copes and drags.

The knock-down feature permits of a minimum of storage room, and, if ordinary care be exercised in keeping the different sizes in proper order, the assembling should be done by common labor and in much less time than that required to readjust and repair wooden flasks. While the A & D iron flask is made in sections, it is claimed to be just as rigid as a solid flask and should commend itself just as thoroughly to multiple work as to jobbing.

The A & D snap flasks are made entirely of aero metal and are claimed to be 30 per cent. lighter than wood flasks of equal capacity and are certainly much more rigid. They are also built up of interchangeable parts with no loose pieces, thus greatly simplifying the repair problem. Five different sized ends and nine different sized sides allow of making up forty-five different sized snaps.

"Manitoba Engineer."—The 1914 number of the Manitoba Engineer, published by the Engineering Society of the University of Manitoba, has just been issued, and is a very comprehensive work. The issue contains several articles of live interest, particularly among those engaged in engineering and associated professions. The articles are well written, many of them being from the pen of men of high standing in the actual practice of engineering, architecture and surveying. The contributions are set off with numerous illustrations. The contents include the live topical questions of the day, and they are dealt with in a clear, concise and business-like manner. The article on road administration in the Province of Manitoba by A. McGillivray, Provincial Highway Commissioner, tells of the beneficial results to be derived from the construction of good roads. An article on New Manitoba and its mineral possibilities is contributed by Dr. R. C. Wallace. Street Illumination is dealt with by Prof. E. P. Fetherstonhaugh, and fireproof building construction by Thos. M. Goodrich. There are also articles on railway construction, and other topics

SYSTEMATIC BUSINESS MANAGEMENT

Practical Articles for Managers, Superintendents, and Foremen, to Assist in Carrying on the Business Economically and Efficiently.

SAVING TIME IN THE TOOL ROOM.

AN ingenious method of diminishing the time required to secure a tool from the tool room was recently devised by a tool boy in a shop in England. The usual practice in this shop had been for the workmen, whenever they needed a tool, to signal the tool room by means of an electric call bell, push buttons being located at convenient places throughout the shop. A messenger then answered the call, ascertained what was needed, and returned to the tool room for the tool, thus necessitating two trips for each call.

The new scheme comprised placing a blackboard at each push button in the shop, in such a location that it was in clear view of the tool room. The workmen would write on the board the name or symbol of the tool desired, and then signal the tool room. By means of a pair of opera glasses, the tool room attendant read the writing on the blackboard, and a messenger was dispatched at once with the tool, thus eliminating one trip.

EFFICIENCY FROM CENTRE TO CIRCUMFERENCE.

MR. C. W. DICKINSON of the Pittsburgh Dry Goods Co., addressing the jobbers section of the Dry Goods Association in New York recently, said that "efficiency must begin in the directors' room, in the case of a corporation, or in the managing partner's room, if a firm." Continuing, he stated that success in business depends primarily upon the ability of the executives, and if they are not efficient, the workers cannot be expected to do their best. This argument also applies with equal strength to the department managers, as in my opinion, it is imperative that all department heads should have ability to handle the men under them.

How can we acquire this ability? We can do it by educating and equipping ourselves so that we are at all times ready and able to assist those among us who may be in need. We must first consider our subject; then we can describe it and discuss it intelligently.

Returns Proportional to Giving.

Another fact I want to make plain is that a man can get out of life only what he puts into it. By this I mean the knowledge he can absorb and apply. Success is largely a matter of mind, consequently we need to educate and enlighten our under-men. We must help to create in them a desire to grow and to become more efficient in order that they may rise to a higher position and be of greater value to themselves and our organizations.

To advance, a man must outgrow his position—he must be bigger than the job he holds. It must be borne in mind, however, that he cannot be educated and equipped in a week, or a month, or a year, and we must not encourage a man to expect quick results without application, but must make him understand that only as he fits himself for higher positions can he expect to find them.

We who are at the head of an enterprise are responsible for the men under us. We should remember that just as we once looked to our superiors for sympathy, commendation, etc., so also do they look to us. We must not be nickel-wise and dollar-foolish, but must remember that a broad and liberal policy is the one that wins to-day. We are all human, and everyone of us can, and does make mistakes. When our employees make mistakes we should teach them not to repeat their error, show them what the mistake means and turn it into a valuable asset.

The public is the judge of service, and this is emphasized by the fact that service, more than any other factor, is what has built up the big organizations of to-day. We thing we know when we give proper service, but only our customers can decide the question finally. One of our great problems is to get the right kind of people and to select the ones who will take more than an ordinary interest in their work. Such people are difficult to find. We cannot get them away from other employers, except in individual cases, because the men who have such help usually appreciate it, therefore we must look ahead.

According to my view, the best way is to take the juniors (the raw material), and fashion them by educating and equipping them for the call that is sure to come. If we do this, we start them right; they get our ideas from the beginning; they have nothing to unlearn, and, in the long run they will make the best and the most efficient help we can hope to secure. We must teach our employees as to values, and must show them, when we can, how goods are made. Tell them all we can of the process of manufacture and everything that is, in any way, connected with the duties they are to perform. Then when they undertake to make a sale, they are equipped as well as it is possible for us to equip them.

Business Attributes.

Efficiency is a big subject, but there are other things that make for a salesman's success. One of the most important of these is courtesy. I call it the business lubricant, because it is a vital necessity. Another is promptness. We live in rapid transit times and new conditions are arising daily. Promptness means, in many cases, ability to meet these new conditions.

I might also mention loyalty. This is one of the attributes, the lack of which we cannot excuse. No man can put forth maximum effort without loyalty. A man may be incompetent, but if he is loyal we can get something out of him. We can, at least, trust him. But the man who is competent and disloyal, we have no use for.

Finally, we must realize that no one department is the whole thing and that the organization is made up of many units. The realization of this fact makes for harmony, whereas discord makes for inefficiency.

EFFICIENCY ENGINEERS.

"THE SILENT PARTNER" for February contained an editorial commenting on the herd of "business doctors" who are flooding the country with their "cure all" literature.

What "The Silent Partner" says is true enough, but don't let us lose sight of the fact for a moment that there is any difference between efficiency and any other profession. We have our grand doctors of medicine, gold-brick artists, chicken-coop architects, grafting politicians and fakirs of all kinds, consequently all that one need do is to take the destructive article appearing upon the subject of "Efficiency Engineers" and substitute almost any title of another profession, and it would still read true. Every profession from time immemorial has had to bear up under its share of imitators or fakirs, but no real harm has ever come to any profession supported by principle and backed by actual accomplishments.

Many cases can be cited as to the effectiveness of efficiency and the wonderful constructive work of its successful engineers, as against each single case of failure from some new recruit or over-enthusiastic worker. Everyone is liable to err, no one man or profession is 100 per cent. perfect, but the large percentage of efficiency work is constructive, no

matter how poor it is, because business as a whole is so largely inefficient.

Occasionally one hears of a firm which is recovering after having been "done up" by a so-called "Efficiency Engineer," but invariably an inquiry will elicit the fact that no one ever gave the man the title of "Efficiency Engineer," outside of the firm who engaged him, and they are only suffering from an effort to get something for nothing. The firms accepting free service from companies with something to sell, without knowing the value of suggestions as applied to their problems, or the firms that have not yet learned to appreciate the value of competent counsel, and who engage a ten-dollar man to do a hundred-dollar job, are entitled to the same sympathy that is given the farm who buys the "gold brick" or the man who goes in on the "wire tappers" game.—Efficiency Magazine.

NEED FOR EFFICIENT EMPLOYEES.

MR. WILLIAM WILCOX, president of the Efficiency Society, in a recent talk at the West Side Y.M.C.A., New York, said that "the world is full of men who can do the commonplace thing. It is full of men who can put their hands to many things in an ordinary way, but if I want a man who can do some one thing a little better than someone else has done it, I have a hard time finding him. Men who are experts are the ones who get to the top. Some big places in this city are occupied (notice, I say occupied) by men who have got up through luck and pull, but the great majority of big places are filled (not occupied, but filled) by men who are where they are because they can do something better than anyone else."

Arthur Williams, chief inspector of the New York Edison Co., and president of the National Association of Corporation Schools, speaking on the same occasion, said, "the efficiency to be striven for was not that which means the speeding up of employees with more dollars for the employer as an immediate result, but that which tends to make a man or woman a better man or woman, a better developed social unit, producing normally and consuming normally."

STANDARDIZING THE SIZE OF CATALOGUES.

THERE is a movement on foot, says the Efficiency Magazine to have a more efficient system of issuing catalogues, and a campaign has been started by the Technical Publicity Association, whose membership comprises the advertising managers of many of the largest business houses in the United States, to induce firms to adopt standard catalogue sizes. Definite proposals have been prepared by the association and have been sent out to all the leading manufacturers, wholesalers and retailers.

The chief recommendation is that two sizes be adopted as the standards for all catalogues—6 by 9 inches and 8½ by 11 inches. If every house issuing a catalogue will have it made in one of these sizes, it can be filed for reference with other catalogues by anyone receiving it. With the present system of varying sizes, they take up valuable space unnecessarily. Many of the advertising and manufacturing firms have expressed their approval of the plan, and there seems to be every reason for its adoption. The chief of the catalogue department in one firm recently measured the catalogues of 700 houses, and found 147 different sizes among them, varying from pocket editions to immense books that would almost cover the top of a desk. The only possible objection to this standardization is that each manufacturer or wholesaler wants individuality in his catalogue, but this can be obtained by color and thickness as well as in size.

The advertising managers of the New York Telephone Co., the General Electric Co., the Western Electric Co., and the Texas Co., are among those who have indorsed the standardization movement.

VENTILATION OF OFFICES.

ONE of the most important things in an office is the question of ventilation, but it seldom receives much consideration. In this connection it might be well to adopt a plan which proved very successful in a school in Syracuse.

The lower sash is raised in four or five windows and the opening fitted with a wood frame covered with medium weight unbleached sheeting. The room in which the experiment was first tried had five 30 by 40-inch windows facing the east. Steam pipes extended across the room under the windows, and a hot air inlet 30 inches square was on the north side half way from the floor to the ceiling, with an exit opening of the same size near the floor.

In the morning before school opened, the room would be warmed by hot air driven by a fan. When school began, this hot air inlet would be closed and all the windows opened, so that there would be 50 square feet of open window space. The cold, fresh air would suffuse slowly into the room and would be met by the hot air rising from the steam pipes, so that no drafts were noticeable. The temperature of the room was maintained at 68 or 70 degrees as easily as before the screens were used, and the atmosphere very considerably purified.

CONCERNING EFFICIENCY.

THE study of methods is right and wise, but the thing to be done furnishes a better slogan than the method of doing it.

A slogan is a battle-cry, and it is not reasonable to stop the battle in order to fight over how we are going to conduct it. As a matter of fact, a great deal of present-day talk about efficiency is simply a diversion. Much alleged progress and up-to-dateness, and many exhortations to "get on to the job," are purely cant. Calls for men with "red blood in their veins" often indicate only a shortage of "gray matter in somebody's cranium." Many industrial movements fail to accomplish what they might, because of the inferior ideals set forth in their slogans, maxims, and literature.

One of the worst effects of the mere efficiency cry is the steely hardness it develops, the cold calculation of the leaders, and the discouragement of the weaker elements.

INCANDESCENT LAMPS FOR LARGE AREAS.

A HIGH candle-power incandescent lamp operating at an efficiency of approximately 0.6 watts per c.p., which is 33 per cent. higher than any efficiency yet attained in a commercial incandescent lamp for standard lighting circuits, has been brought out by the Westinghouse Lamp Co., Bloomfield, N.J. It is made in 750 and 1,000-watt sizes, the former giving approximately 1,100 c.p. and the latter 1,650 c.p. The filaments in the lamp consist of a closely coiled tungsten wire supported by anchors, and the light given is said to approach sunlight more closely than any other form of incandescent lamp.

On account of the great brilliancy of the filament, the manufacturer recommends that the lamps be used with some kind of diffusing reflector, which adapts them for indirect or semi-direct lighting of large areas in factories and mills. The lamps are intended for operation on direct or alternating current circuits of any frequency in commercial use at the present time, where the voltage is between 100 and 130.

Manufacturers' Census. — The last United States census of manufacturers is highly inefficient. For practical business purposes it has little to offer. A large house dealing with a certain class of manufacturers has therefore ordered a real and detailed census taken in the big industrial centres. With the data which is being secured, there will be possible a very active and wasteless campaign, which it is figured will in four months' time repay the cost of the census in postage saved alone.

Trade Gossip

Toronto, Ont.—A fire in the boathouse of the Marine Construction Co. at the foot of York street, did considerable damage. The building, which is owned by the C. P. R., was damaged to the extent of $1,500, while the loss to the contents will amount to $2,000.. The whole is fully covered by insurance.

Haileybury, Ont. — Improvements to the Haileybury water front costing several thousands of dollars will be made during the coming season and these improvements include the construction of a new wharf surrounding the market building and extending on each of the three sides for fifty feet, and a second wharf between Main and Marcella street.

Lakes Insurance.—A meeting of the Lake Underwriters' Association will be held shortly to fix the rate of insurance for the current season, which begins at midnight, April 15. In spite of the heavy losses occasioned by the disastrous storm on Lake Huron on November 9, last, when Canadian tonnage suffered a heavy blow with the sinking of four large freighters, together with a large loss of life, it is intimated by the underwriters that it is not likely the rates will be increased this year.

Navigation Companies Merging. — Negotiations are at present in progress looking toward the amalgamation of the Northern Navigation Co., and the White Pass and Yukon Route, which is largely owned by the Guggenheim interests. The Northern Navigation Co. has a fleet of thirty steamers, barges, etc., and has assets of approximately two million dollars. The boats are operated between Dawson and St. Michael, a distance of about 2,000 miles. The present overtures are being made by the White Pass and Yukon Route people largely on account of the rate war carried on in the north last year.

Twin Port Shipments.—According to figures compiled by Joseph Redden for the Port Arthur Board of Trade, the combined ports of Port Arthur and Fort William, with shipments of 203,328,129 bushels of grain in the navigation year of 1913, lead all ports on the continent of America in shipments of grain. Figures for the leading ports are as follows:—

Pt. Arthur-Ft. William	203,000,000
Buffalo	172,000,000
Duluth-Superior	115,000,000
Montreal	54,300,000
Chicago	54,000,000

Another fact brought into prominence by the same compilation of figures is the remarkable increase in the shipments from these ports in United States vessels. In four years the amount of grain taken out of Port Arthur and Fort William by United States vessels has increased by approximately five hundred per cent., while the increase in the amount taken out in Canadian vessels during the same period has been ninety per cent.

C.P.R. Marine.—An important change has been made in the management of the Marine Department of the C.P.R. in the eastern section. It has been announced that Capt. J. T. Walsh, who has been marine superintendent at St. John, N.B., during the winter season, has been made chief marine superintendent of all the Atlantic and Atlantic coast services of the C.P.R. with W. J. McGiffin as marine superintendent at St. John, and Capt. G. O. R. Elliott as marine superintendent at Halifax. Captain R. Archibald, formerly superintendent of the Bay of Fundy steamship service, relieves A. McGregor.

To Secure Canadian Trade.—The apparent indifference of British manufacturing firms towards Canadian import trade has prompted the Canadian Chamber of Commerce in London, England, to establish a British manufacturers' section. Nearly one hundred firms, among them some of the most prominent in the country, have joined the section and it has been decided to take collective action immediately for a campaign to capture a greater proportion of the import trade of the Dominion in manufactured goods. Another matter that will receive early attention will be the Canadian transportation problem, taking into consideration the freight position as it will exist consequent upon the working of the Panama Canal.

The Trent Valley Canal.—The contract for the second section of the western end of the Trent Valley Canal between Lake Simcoe and Georgian Bay has been awarded by the Government to the Inland Contracting Co. of Toronto. The amount of the contract is $712,258. The Severn River section was let some time ago to the York Construction Co. The contracts for the two remaining sections will be let in the near future, and it is expected that work will be in progress this summer, along the whole route from Lake Simcoe to Georgian Bay. The southern end of the canal, from Lake Simcoe to Trenton, will, it is expected, be practically completed by the end of this year. It will probably take two years yet to complete the western end of the canal.

Siemens Co., of Canada, Ltd., have received an order for 2 and 4-core submarine cable for service between Prince Edward Island and Nova Scotia, the total length in all being 28 miles. The 2-core cable is for telephonic purposes and the 4-core cable is for telephonic and telegraphic purposes.

Saskatoon After C.N.R. Shops.—Mayor Harrison and Alderman Potter and Anderson left Saskatoon a few days ago for Winnipeg to meet General Manager MacLeod, of the C.N.R., and bring all possible influence to bear to assist W. A. Silverwood, owner of the townsite of Factoria, to secure the location of the C.N.R. shops on his property. Factoria adjoins Saskatoon on the north, and is in the immediate vicinity of a half section of land owned by the railway company. It is commonly understood here that the C.N.R. have large plans in the making in connection with their western shops, and that it is only a matter of time until an announcement will be made that Saskatoon will be the chosen spot for the shops.

Steamship Offices Removal. — As the result of the merger of steamship companies under the name of the Canada Steamship Lines, Ltd., Port Arthur, once more comes in for a big loss, in the fact that the offices of the company are to be located at Fort William in the future. The offices of the Northern Navigation Co., which have been under the management of Mr. Brock Batten for so many years, and the offices of the Merchants Mutual Line which have been in charge of Mr. Walter W. Hall, will move to Fort William at once. The Canada Interlake Line, the Canadian Lake Line and the Inland Lines offices removed to the neighboring city some time ago. All these companies which form the merger will go into one big office at Fort William, and it is expected that a staff of 30 or more will be employed.

The York Mfg. Co., York, Pa., have recently made the following installations in Canada: R. Barron, Ltd., Toronto, Ont.; One 11-ton vertical single-acting belt-driven enclosed type refrigerating machine and high pressure side complete; O. W. Kaufman, Hagersville, Ont., one 4-ton vertical single-acting belt driven enclosed type refrigerating machine and high pressure side complete; Ryerson Bros., Ltd., Brantford, Ont., one 4-ton vertical single-acting belt driven enclosed type refrigerating machine and high pressure side complete; T. Long & Bros., Ltd., Collingwood, Ont., one 17-ton vertical single-acting belt driven enclosed type refrigerating machine and high pressure side complete; J. Y. Parkhill & Co., Ltd., Kingston, Ont., one 5-ton vertical single-acting belt driven enclosed type refrigerating machine and high pressure side complete.

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Toronto—143-149 University Ave. Telephone Main 7324.

Winnipeg—34 Royal Bank Building. Phone Garry 2313.

UNITED STATES—

New York—R. B. Huestis, 115 Broadway, New York, Telephone 8971 Rector.

Chicago—A. H. Byrne, 140 South Dearborn Street, Room 607. Telephone Randolph 3234.

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GREAT BRITAIN—

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Subscribers who are not receiving their paper regularly will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. XI. APRIL 2, 1914 No. 14

PRINCIPAL CONTENTS.

SAFETY ENGINEERING.

THE impending legislation in the Province of Ontario relative to workmen's compensation is giving those who direct and manage our industrial enterprises more or less concern because of the far-reaching nature of the proposals which are sought to be placed on the statute book. The fact, however, that seven thousand workmen in Canada come to their death or to serious injury every year in the pursuit of their daily avocations seems to justify more or less drastic law-making or an equivalent whereby a wholesale reduction of the above life waste will be secured. The latter or equivalent remedy only is here discussed.

The immediate necessity of preventing accidents due to any and every cause has brought our factory managers face to face with a new problem that, to many, has proved more or less perplexing. The outcome of this condition has been the appearance of many self-made and self-styled "safety engineers," although the well-rounded man conversant with all branches of this work is still a rarity. The work of the average safety engineer exists within the bounds of selecting, designing, constructing and applying of safety devices to buildings and machinery, and often in these spheres he does not enjoy the heartiest co-operation of the operatives; the latter being inclined, particularly at first, to characterize his work and presence as more or less of a nuisance. While the foregoing is a very necessary part of safety engineering, it embraces but a small percentage of the total number of accidents, besides, most modern machinery is so well guarded that the further addition of devices for the protection of the workman is more or less superfluous.

By far the more important branches of this science are, the rigid inspection of all machines and buildings, the maintenance of good order, cleanliness of factories, and the careful training of employees to adopt only safe methods of going about their work. We have seen the work supports and other attachments of grinding wheels allowed to be so worn that attempts to use them in the way they were originally intended would be more dangerous than any possible centrifugal force in the wheel itself. Again, the operating mechanism of punch and forming presses is often permitted to get so out of order as to make the action of these dangerous machines very uncertain. Such impediments to prompt and good work as holes in floors, unsafe staircases and tools out of place are also exceedingly common. More accidents are caused by tools and appliances that have outlived their usefulness and could be discarded with propriety, and by ropes, slings and methods that should be condemned, than by unguarded machines the danger of which is generally well-known to all workmen. The dangerous nature of such things as exposed set-screws in revolving shafts and unguarded chains and gears should be thoroughly apparent to any thinking man, not to mention the properly trained foreman.

In short, the largest part of safety engineering consists in maintaining the essentials to convenience and efficiency of production in our plants. If we could maintain the always necessary efficiency engineer at his proper standard, the need to requisition the services of a safety engineer would be reduced to a very satisfactory minimum.

Courage consists not in blindly overlooking danger, but in meeting it with the eyes open.—Richter.

• • •

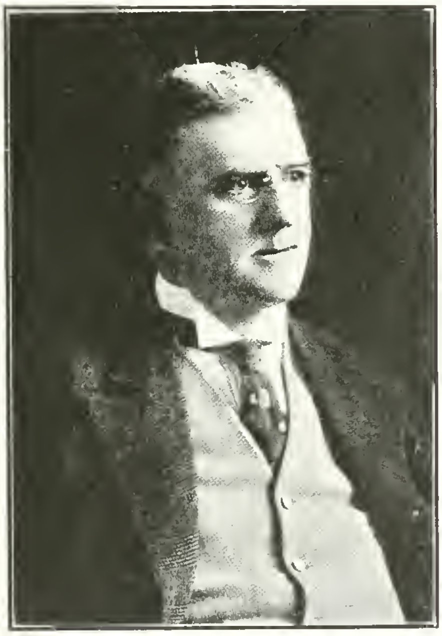
The science of business is the science of rendering service—he profits most who serves best.

INDUSTRIAL NOTABILITIES--No. 28

FRANK ASHMORE SKELTON was born Jan. 19, 1870, at Sheffield, England. His father, Frederic Skelton, is managing director of The Canadian Shovel & Tool Co., Ltd., of Hamilton, Ont. The paternal ancestors came from the Lowlands of Scotland and North Britain, while those on the maternal side came from Ireland. An uncle, Sir Charles Skelton, J. P., lives in Sheffield, England.

Frank Ashmore Skelton was educated at private and public schools in his native city, and on his coming to the United States, he first became a blacksmith's helper at the Rhode Island Tool Works, Providence, R. I., and then a milling machine hand with Brown & Sharpe Co., of the same city.

In 1889, he was freight clerk at Kansas City, and in 1890 he joined the Audit office of the Vandalia R. R., being later, and until 1900, motive power and maintenance of way clerk with the same company. From 1901 till 1906 he was chief clerk and assistant auditor of the Pressed Steel Car Co., McKees Rocks, Pa., and of the Pressed Steel Car Co., Pittsburgh, Pa., respectively.



FRANK ASHMORE SKELTON.

In 1906, the subject of our sketch became secretary-treasurer of the Canada Car Co., Ltd., Montreal, and since 1909 he has been secretary-treasurer of the Canadian Car & Foundry Co., Ltd.

Mr. Skelton also holds the following offices: Director and secretary-treasurer Canadian Steel Foundries Co., Ltd., Montreal; director and secretary-treasurer of the Pratt & Letchworth Co., Ltd., Brantford, Ont.; director of the Rhodes Curry Co., Ltd., Amherst, N.S.; director and vice-president Storage & Transfer Co., Ltd., Hamilton, Ont.

He is a member of the New York Club, of New York City; The Engineers Club of Montreal; The Manitou Fishing and Game Club of St. Agathe, Que.; The Montreal and Montreal Country Clubs; The Royal St. Lawrence Yacht, and St. George Snow Shoe Clubs, Montreal, and of the Montreal Amateur Athletic Association.

Mr. Skelton was married Oct. 14, 1896, to Frances Elizabeth Miller, of Brooklyn, N.Y., the union being blessed with three children, Hugh Miller Skelton; Neil Kennedy Skelton, and Bernice Skelton.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	15 25
Middlesboro, No. 3	19 50	20 00
Carron, special	24 25	.....
Carron, soft	24.25	.....
Cleveland, No. 3	19 50	20 00
Clarence, No. 3	19 50	20 00
Jarrow	.....	23 50
Glengarnock	......	26 00
Summerlee, No. 3	22 00	.....
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1	19 00	18 35
Victoria, No. 2X	18 75	18 10
Victoria No. 2 Plain	18 50	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh	$20 00
Open hearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	24 00
Wire rods, Pittsburgh	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.00
Steel bars, f.o.b., Toronto	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal	2.05
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails	75 per cent.	
Pressed spikes, 5/8 diam., 100 lbs.		2 85

BOILER PLATES.

		Montreal.	Toronto.
Plates, 1/2 in. 100 lbs.		$2 20	$2 20
Heads, per 100 lbs.		2 55	2 55
Tank plates, 3-16 in.		2 50	2 50
Tubes, per 100 ft.,	1 inch	9 50	9 00
" "	1¼ in.	9 50	9 00
" "	1½ "	9 50	9 00
" "	1¾ "	9 50	9 00
" "	2 "	8 75	8 75
" "	2½ "	11 15	11 50
" "	3 "	12 10	12 50
" "	3½ "	14 15	14 50
" "	4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws	75
Plate Washers	45
Machine bolts, 3/8 and less	65 & 10
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼ per lb off
Nuts, Hexagon, all sizes	4½ per lb off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright	85, 10, 7½, 10, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, bronze	70, 10, 7½, 10 p.c. off

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in.	75%
Finished Nuts over 1 in.	72%
Semi-Fin. Nuts up to 1 in.	72%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	12 00	12.00
New brass clippings	8 50	8 75
No. 1 brass turnings	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
1/8 in	$ .05½	1/8 in	$ .12	½	$. 32
¼ in	.06	¼ in	.07½	¾	.35
3/8 in	.06	3/8 in	.07½	1	.37
½ in	.08½	½ in	.11	1¼	.52½
¾ in	.11½	¾ in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼ in	.23½	1½ in	.30	2½	1.37
1½ in	.27½	1½ in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½ in	.58½	2½ in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½ in	.92	3½ in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½ in	1.27	4½ in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	.....	...	.....
10 in	3.50	....	.....	....	.....
10 in	4.12	....	.....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, 3/8 in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in.	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in.	73	63	72	62
4½ to 6 in.	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, 3/8 in	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in.	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in.	....	....	66	56
4½ to 6 in.	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in.	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload	$16 00	$15 75
Electrolytic copper	15 50	15 25
Casting copper	15 00	15 00
Spelter	5 25	5 25
Tin	40 00	41 00
Lead	4 85	5 30
Antimony	8 50	8 50
Aluminum	21 00	19 00

SHEETS.

	Montreal.	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4.30	4.10
Queen's Head, 28 B.W.G.	4.40	4.20
Fleur-de-Lis, B.W.G.	4.20	4.20
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.20	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal.	0.22
Pure turpentine	0.69
Linseed oil, raw	0.60
Linseed oil, boiled	0.63
Plaster of Paris, per bbl	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

THE BUSINESS OUTLOOK.

NOT all Canadian financiers are of the same mind regarding the outlook. A majority have, however, expressed for publication favorable opinions regarding the immediate future of the Dominion. One of our most prominent banking authorities says that:

"It will take Canada more than a few months to recover from the set-back which she has received. Money has been poured into this country in the past few years and enterprises undertaken which ought never to have been begun at all. The total fixed charges on money borrowed by us is an immense sum, and we will have a hard time meeting this in the years to come.

"The railways have been vastly overdeveloped. Not three, but one good transcontinental line was what we needed. The sum already expended on the two latest roads is very great; and a great deal more money will yet have to be spent before the roads are completed. Then there is the question of business for these roads after they are finished. It will take a great deal of traffic to meet the charges on the money expended on the lines.

"I repeat that I believe that it will take not only one year, but many for Canada to recover from the rash spending of the last few years."

Montreal, Que., March 30, 1914.—While conditions are still decidedly dull there is some slight improvement over last week. With the opening of navigation again at hand, it is felt that Montreal's trade is about to show a more pronounced activity than it has done for the past month or two.

Orders have now been placed for the machine tool equipment recently listed in **Canadian Machinery** as being required by the Canadian Buffalo Forge Co., for their new plant at Berlin, Ont. Mussens, Ltd., have recently received an order for a 15-ton Brown Hoist locomotive crane to be delivered to the Sackville Freestone Co., Sackville, N.B., and have to-day booked an order for a Rahn-Larmon 24-inch extension bed gap lathe, the purchasers being Baldry, Yerburgh and Hutchison, who will use it in connection with their contract on the new Welland Canal.

The railways are buying very little machinery and other supplies as yet, but Sir Thomas Shaughnessy is said to look for a rapid increase in business shortly, Western stocks being very much depleted. This means that traffic earnings should show an improvement from now on, enabling the railways to spend more freely on new equipment.

In political circles at Ottawa the impression seems to be gaining ground that subject to certain stringent conditions, aid will be granted to the C.N.R. It is recognized that the country's interests demand that the road should be speedily completed and that the company should not be allowed to suspend construction or default in its financial obligations. Several of the provinces which are involved in guarantees with the C.N.R., particularly British Columbia, are urging a favorable consideration of the question by the Federal Government, and these influences will doubtless carry considerable weight. Less influential concerns than the C.N.R., however, who try to raise money just now are still being received by the banks in a cautious manner, and have to submit their propositions to the most minute scrutiny.

The Metal Market.

There is a fairly brisk trade being done in steel bars and plates, galvanized sheets, etc.; but pig iron remains very dull. In fact there is no life in any branch of the metal market. An improvement is looked for, however, with the opening of navigation.

Toronto, Ont., March 31, 1914.—The substantial improvement looked for this month can hardly be said to have materialized. In February a low water mark was reached, and it was then anticipated that by the end of March a much-improved condition would be manifest. We must, however, confess to being disappointed. The banks are accumulating money, but the confidence in business circles that we would expect from this does not appear to have resulted. It is difficult to obtain loans at a normal rate, with the result that large buyers and municipalities are holding off until the money market is easier.

The outlook in the steel trade is uncertain. A close survey of the situation leads us to believe that prices for second quarter delivery will not show any improvement over those obtaining during the quarter just closing. We are advised that the mills are now endeavoring to maintain prices, efforts to raise them higher not having been successful. Fewer large buildings requiring steel are being projected than is usual at this time of the year. This will have an effect on the demand for structural shapes. The agitation which is being made by the steel interests for assistance from the Government will have a tendency to create a spirit of uncertainty until a decision is arrived at. What form this assistance will take has not been decided, but if the principle of giving assistance is accepted, it will no doubt be in some form of bonus. Reports from the United States indicate that operations at the mills will have to be restricted unless the demand becomes heavier. The railroads are not placing such large orders for rails and equipment as was anticipated.

The pig iron market shows no improvement; prices remain the same, and the demand is light. We believe that an effort is being made by the makers to raise prices, but it is doubtful if they will be successful owing to the small volume of business being done.

Dealers in machine tools report fairly satisfactory conditions. The improvement reported last week has been maintained, but, although no large orders have been received, a number of smaller

ones have been booked. One firm of dealers reports having secured a nice order, including a Brown & Sharpe milling machine, an electric grinder, furnaces and a press. Another firm has sold a LeBlond grinder, a Hendey and a Rivett lathe. A number of nice inquiries have been received, but are being held at that, presumably for financial reasons.

The weakness in the metal market is still apparent, the volume of business is small, and no change of prices can be reported.

Winnipeg, Man., March 28, 1914.—The first steel steamboat built in Winnipeg has just been completed at the plant of the Doty Engine Works. It has been constructed for the Hudson's Bay Company, specially for navigation in shallow rivers. The vessel will be taken to pieces and reassembled at Fort McMurray.

Several firms in Winnipeg and throughout the West are making preparations for the erection of new plants. L'Air Liquide Society, 325 William Avenue, manufacturers of oxygen, are looking for a site, and will erect a plant during the spring. The Gilbert Hunt Manufacturing Co., Maple Creek, Sask., are preparing to erect a plant on Jasper Street for the manufacture of implements. Henry Birks & Sons, jewelers and silversmiths, who are building a new plant, are in the market for machinery.

Inquiries for machine tools coming in are healthy, but manufacturers seem to be deferring their buying until conditions have improved. If this year's crop be good, it is believed that business will speedily return to normal. Most local dealers are disposing of small lots of tools to garages and small machine shops, but the railways are not buying, except what they are absolutely in need of. The transmission, equipment and general repair business is in excellent shape, the demand for belts and pulleys being quite large. There is a fair demand for steam and hydraulic plant accessories.

The Stuart Machinery Co. secured the order for two of the machines required by the Riverside Lumber Co., Calgary, who are erecting a new barrel plant, the remainder of the order going to the Berlin Machinery Co., Hamilton. A large amount of woodworking machinery is being bought throughout Alberta. Several new mills are going up in British Columbia, and there should be a call for machinery from that quarter before long.

Good progress is being made on the Manitoba Rolling Mills at Selkirk, Man., which is a new plant being erected near Winnipeg. The boiler house is practically completed, and work should soon start. The Stuart Machinery Co. recently secured the Manitoba, Saskatchewan and Alberta agency of the American Woodworking Machinery Co., Rochester, N.Y.

GEORGIAN BAY CANAL COMMISSION WORK.

THE character of the inquiry respecting the Georgian Bay Canal is set forth in an Order-in-Council made public on March 28, following a conference between Mr. Sanford Evans, of Winnipeg, and Col. F. H. Meighen, of Montreal, with Hon. Robert Rogers. Commissioner Edouard Gohier, of Montreal, is in Europe, but is returning shortly, when regular meetings will be held, and the inquiry proceeded with. Mr. J. D. Hepburn, who for many years has been connected with lake transportation, is secretary of the commission, and will start at once to collect preliminary data. The inquiry will cover the following points:

Scope of the Inquiry.

(1)—A study of the transportation problem in relation to the proposed waterway.

(2)—The advantages of a large waterway from the lakes to the seaboard open to the largest type of lake carriers; the feasibility of these carriers navigating such waterway, and the influence on the rate regulation of transport.

(3)—Competition of the waterway with the railways; effect on railways by creating new industries on account of cheap transport of low-grade freight that cannot be handled by rail.

(4)—The probable volume of traffic available on account of the natural advantages of such waterway.

(5)—Causes for diversion of Canadian traffic to United States ports.

(6) Lake rates and a general comparison with railway rates and relative volumes of traffic.

(7)—The position of the North-West, and how the situation at the head of the lakes would be ameliorated.

(8)—The position of the existing and projected gulf lines via Galveston; what their influence would be with regard to the diversion of traffic from the lakes and St. Lawrence route; the effect upon the movement of the traffic by the opening of the Hudson Bay and Pacific and Panama routes.

(9)—Conditions on the Atlantic seaboard as to handling traffic and as to ocean and insurance rates.

(10)—Interprovincial trade and facilitation of exchange of eastern and western products owing to lower rates.

(11)—The canal as a factor in developing the iron and pulp industries and other resources.

(12)—The development of water powers along the route and the tendency to manufacture at the base of supply.

(13)—New territory which may be opened in the North-West and cost of transportation of wheat to the head of the lakes.

(14)—Storage at lake and seaboard terminals.

(15)—Markets, statistics, history of canals and their development.

(16)—Generally speaking, the commercial feasibility of the proposed waterway.

N.Y.C. REDUCES OPERATING FORCE.

DISMISSAL of 25,000 men by the N.Y. Central Railroad since December 1, said A. T. Hardin, vice-president of that road on March 28, is only a barometer of the company's business. "The reduction of forces was not arbitrary," he added. "It came about gradually as traffic, mainly freight declined, and while I don't want to be a pessimist, I cannot see any immediate prospect that business will pick up and these men come back to work." Mr. Hardin said this condition affected most of the Eastern railroads.

Of the 25,000 men dismissed by the New York Central, about 15,000 were laid off on lines each of Buffalo, and 10,000 west of Buffalo. Although the reduction affected all branches of the service, the employees of the construction, the operating, and the maintenance-of-way departments suffered most.

"Compared with 1913," said Mr. Hardin, "the business of this year on the New York Central suffered a reduction of from eight to ten per cent. The reduction of the working forces has been on the same ratio."

Kayser, Ellison & Co., of Sheffield, England, have opened a Canadian office at 126 Craig street, W., Montreal, where a full stock of high grade tool steel will be carried in addition to wire and drill rods. Mr. Ralph B. Norton is in charge.

The Turbine Equipment Co., Toronto, report recent sales as follows:—Two De Laval multi-stage motor driven pumps with capacity of 700 gallons per minute against 216 ft. head, and two De Laval single stage motor driven pumps with capacity of 600 gallons per minute against 112 ft. head., for the Canadian Copper Co., Whitson Lake water supply; one De Laval centrifugal pump with capacity of 400 gallons per minute against 70 ft. total head for J. R. Booth, Ottawa. This pump will have a motor mounted on one side and a De Laval steam turbine on the other.

ASSOCIATION AND PERSONAL

A Weekly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Machinery Circles

F. W. Moore has been appointed manager of the Garlock Packing Co., Montreal branch.

Basil D. Hall was elected president of the Peterborough Board of Trade at the annual meeting, held recently.

W. A. Owen has been appointed city engineer of Nanaimo, B.C. The new official has been a resident of Nanaimo for some time.

R. B. Angus, ex-president of the Bank of Montreal and a director of the C.P.R., is expected home from his world tour about the first of May.

H. D. Johnson late with the Canadian British Insulated Co., Ltd., has joined the staff of the Eugene F. Phillips Electrical Works, Ltd., Montreal, as assistant contracting manager.

F. M. Osborne, of Samuel Osborne & Co., Ltd., Clyde Steel Works, Sheffield, Eng., has just completed a trip through Eastern Canada. Heap & Partners, Montreal, are the Canadian representatives of Samuel Osborne & Co.

J. M. Mussen, Canadian Trade Commissioner in Leeds, Eng., who is returning to the Dominion, received a presentation of plate from his Leeds friends, among whom were the American Consul.

Ben. W. Folger, of Kingston, Ont., died in Toronto on March 26, aged 76. Mr. Folger was one of the founders of the Thousand Islands Steamboat Company, and later was instrumental in establishing the Kingston, Portsmouth, Cataraqui Electric Company.

F. A. Gaby, chief engineer of the Hydro-Electric Commission, addressing a meeting of the members of the Canadian Institute, recently in Toronto, described the work of the Commission at length and told of the remarkable expansion of the power system in Ontario. He said that millions of dollars were invested in hydro power by Ontario municipalities, and every dollar of it was bringing in full returns. Mr. Gaby quoted statistics respecting the tremendous development of the scheme during the past three years.

William Millar recently arrived in Montreal, to take up the position of general manager with Geo. Anderson & Co., of Canada, Ltd., who have moved into more commodious offices in the Quebec Bank Building, Montreal. Mr. Millar has been with the parent company at Carnoustie, Scotland, for 14 years, latterly occupying the position of gas engine expert. He is much interested in this branch of engineering, and hopes to see the suction gas engine much more widely used in Canada than it is at present. Geo. Anderson & Co., in addition to building gas engines, are widely known as makers of stone cutting machinery and cranes of all types.

WHO'S WHO.

EARL F. HETHERINGTON, Publicity Manager, The Goldie & McCulloch Co., Galt, Ont.

C. M. A. and Workmen's Compensation.—To emphasize their protest against certain provisions of the Workmen's Compensation Bill now before the Legislature, an emergency meeting of the Canadian Manufacturers' Association has been called for Thursday and Friday of this week in the King Edward Hotel, Toronto. The object of the meeting is to discuss the proposed Bill in every aspect, and consider plans for placing the objections which the manufacturers take to its principles before the Government. Already the Bill is going through the committee stage, and whatever changes the manufacturers desire, if they are to be granted, must be determined upon quickly.

Trade With Portugal.—Mr. Frederick Nicholl, Consul for Portugal, asks publication of the following letter received by him: "Being desirous of enlarging our commercial business, especially the foreign one, the directors of the Commercial Association, Lisbon, have approved of the installation of a room for catalogues of the most important commercial houses in the world, in order to have their business men acquainted with prices of all articles in the world's market, and for the above reason we ask you to be kind enough to invite by the most practical means the commercial houses of your district that export their products to present their catalogues to the association." Catalogues should be addressed to the Associacao Commercial de Lisboa, Lisbon, Portugal.

Canadian Pig Iron Production.—The production of pig iron in Canada in 1913, including ferro-silicon, ferro-titanium, and ferro-phosphorus, amounted to 1,015,118 gross tons, against 912,878 tons in 1912, an increase of 102,240 tons, or nearly 11.2 per cent. The production in 1913 was much the largest in the history of the Dominion. For the first time the output exceeded 1,000,000 tons. Of the total 986,848 tons were made with coke and 28,270 tons with charcoal, coke and electricity, etc., against 886,506 tons made with coke and 26,372 tons made with charcoal, coke and electricity, etc., in 1912.

Expects Improvement.—In the annual report of Steel & Radiation, Ltd., the general manager, R. J. Cluff, states that, judging from the amount of unfilled orders on file with the company, and the numerous building permits which the sales department has listed, it is believed that with the easing off of money, building operations in Toronto will commence early this spring. He anticipates a considerable increase in sales. Mr. Cluff points out that Steel & Radiation, Ltd., had an increase of 25 per cent. in sales last year, despite the fact that the universal money stringency checked building operations. In November and December, 1913, business dropped materially, falling below 1912.

Canadian Allis-Chalmers, Ltd., Toronto, have been appointed sole agents in Canada for the Lidgerwood Manufacturing Co., New York. This company manufacture a complete line of hoisting engines, cableways, derricks, rapid ballast unloaders, etc.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Kerrobert, Sask.—The Grand View Iron Works, of Vancouver, are negotiating to establish a plant here.

Kingsville, Ont.—The Dominion Stove Co. will build a factory. J. C. Pennington, architect, Windsor, is preparing plans.

Bridgeburg, Ont. — It is announced that an automobile factory will be built at Fort Erie. The total cost is estimated at $200,000. O. T. Johnston, of Toronto, is interested.

Canora, Sask.—A. D. Hilts, of Glenwood, Minn., will probably establish a foundry and machine shop here. It is estimated that the initial expenditure will be $10,000.

Kerrobert, Sask.—It is stated that the Grand View Iron Works Co., of Vancouver, will build a plant here. The Board of Trade have been approached with regard to a suitable site.

Ingersoll, Ont.—The Wilson & Short Company of Detroit, automobile manufacturers, have taken over an existing factory here, and will install machinery, some of which will be brought from Detroit. New machinery will be required in addition.

Quebec, Que.—A complete set of new plans and specifications have been prepared by Engineer E. A. Evans, of Quebec, and were submitted to the Lake Megantic Council at its last meeting, covering the construction of the hydro-electric plant on the Chaudiere River.

Collingwood, Ont.—Subject to the scrutiny now pending showing that the by-law has the requisite number of votes, the council of the town of Collingwood may proceed to pass the by-law guaranteeing to the extent of $100,000 an issue of bonds by the Imperial Steel and Wire Co., of Collingwood. The opposition to the previous by-law, which passed, has been overcome.

St. Lawrence Welding Co., Montreal, are vacating their present premises on Roy Lane on May 1. They have secured much larger and more convenient quarters at 138-140 Inspector street. They are also operating a branch in St. Catharines, Ont., where every department of autogenous welding, both shop and portable work, is undertaken. The company expect to open a large number of branches in Canada in the near future.

Galt, Ont.—It is announced that the Perfect Machinery Co. has been organized, with J. Rumble, of Blenheim, president; Wesley Clark, of Guelph, vice-president; and S. L. Clark, of Galt, secretary-treasurer. The concern will be in operation by May 1, and has sufficient orders to keep the plant busy for a year. The company will manufacture grinders, polishers and a line of small drills and lathes.

Winnipeg, Man.—Engineers of the Greater Winnipeg water district are working on plans for the tunnel that will be constructed under the Red River, and through which will be brought the water from Shoal Lake on its way from the eastern part of the aqueduct to the city reservoirs at McPhillips Street and Logan Avenue. It will connect the five-foot steel pipe to the east and the four-foot cast-iron pipe on the city side, and will cost $130,000.

The American Road Machine Co., of Canada, Ltd., are in the market for the following equipment for their new factory at Goderich, Ont.:

- **Large punch and shear.**
- **Turret lathe.**
- **Bulldozer.**
- **Electric Motors.**
- **Heating and Ventilating plant.**

Portage la Prairie, Man.—Mr. Cooper, representing the North American Machine Co., was a visitor here recently looking over the ground with a view to securing a desirable site for the erection of a building to be used by the company as a distributing plant and Western Canada headquarters. While nothing definite can be learned as to whether it has been decided to locate, it is known that he secured a thirty days' option on two sites. The company, which deals in all kinds of farm machinery, has a number of offices in the West, but as yet no distributing point.

Nelson, B.C.—Within 90 days, if everything proceeds smoothly, the new unit at the plant of the West Kootenay Power and Light Company at Bonnington Falls will be completed. It will be of 10,000 horse-power and the largest in British Columbia, and will increase the capacity of the company's two Bonnington plants to 30,000 horse-power. The 10,000-h.p. turbine, supplied by the Allis-Chalmers Company of Milwaukee, is on the ground. The 10,000-horse-power generator and new transformers have been delivered, while the switch-board apparatus is expected to arrive in about one month.

Gibson, N.B. — A company composed of Mr. J. J. McCaffrey, of Fredericton; H. J. McGrath, formerly inspector of concrete on the I.C.R., and T. C. Burpee, formerly engineer of maintenance and ways on the I.C.R., have purchased the I.C.R. foundry at Gibson, and will there manufacture concrete in all forms, both for industrial and ornamental purposes. The new company has a capitalization of $25,000, and Mr. McGrath will become manager, and Mr. Burpee, mechanical superintendent. The field for a business of this nature in the Maritime Provinces seems very bright as the concrete business has not yet developed in these sections in comparison with the development which has taken place in the upper Canadian Provinces.

Electrical

Canora, Sask.—A by-law authorizing extensions to the electric light plant has been passed.

St. Thomas, Ont.—At a meeting of the Hydro Commission on last Saturday afternoon it was decided to purchase a rotary converter at an approximate cost of $3,000 rather than to renew the storage battery at a cost of $6,000.

Owen Sound, Ont.—Engineer Gaby, of the Hydro-Electric Commission, assured Chairman John Legatt, of the Owen Sound electric light and power committee, that hydro power from Eugenia Falls would be available in Owen Sound by next January or February at the latest.

Woodbridge, Ont.—The municipality of Woodbridge will vote on the Hydro-Electric by-law on Saturday, April 11. This has been decided on by the Reeve and council of that village. Should the people decide in its favor, debentures

amounting to $6,000 will be sold to provide the necessary plant and machinery.

The Stanworth Power Co., Ltd., of Toronto, has been Federally incorporated with a capital stock of $250,000. The incorporators include: W. J. Simpson, Stewart W. Hall, Robert E. W. Duke, Alfred Wales and H. G. Hammond. The company is empowered to do a general power development and power distribution business.

Hamilton, Ont.—The Hydro Commission opened tenders last Saturday for the new electric standards for street lighting submitted by the Union Metal Mfg. Co., Galt; the Ornamental Lighting Co., Hamilton, and the Northern Electric Co., Toronto. The Canadian Westinghouse Co. was awarded the contract for a disconnecting switch. The price was $115.

Vancouver, B.C.—The Western Canada Power Co. is arranging for a considerable amount of work in connection with its generating plant at Stave Falls this year as well as on its distribution service, and in July a 13,000-h.p. turbine from Switzerland is to be delivered. Mr. Hayward, the general manager, states that in addition to this turbine there are coming a 9,000-h.p. generator, five 3,000 k.w. transformers from the Canadian General Electric Co., and a large outfit of switchboards from the Canadian Westinghouse Co. These are all for use in connection with the third unit at Stave Falls, the building for which will be completed this summer.

Municipal

Dundas, Ont.—The town council may install a sewage disposal system.

Strathroy, Ont.—The Board of Trade will make an effort to induce new industries to locate here.

Hamilton, Ont.—The city is going ahead with a scheme to develop an industrial area in the west end.

Wilkie, Sask.—The town will spend $7,000 on the waterworks system. Debentures will be issued to cover the cost.

Hamilton, Ont.—Work will begin on April 15 on the new sewage disposal plant. The cost is estimated at $200,000.

Battleford, Sask.—The City Council have decided to complete the waterworks system which will entail an expenditure of $25,000.

Edmonton, Alta. — The Industrial Bureau are raising funds for various purposes, one being the development of the Viking gas field.

Regina, Sask.—The city council have decided to appoint an industrial commissioner instead of making a grant to the Board of Trade.

Victoria, B.C. — The city is in the market for an 8-ton steam road roller. Tenders received by W. Galt, purchasing agent up till April 27.

Sarnia, Ont.—The Board of Trade has received subscriptions amounting to $4,000 towards the $10,000 required for financing a publicity campaign.

Stratford, Ont.—The ratepayers will probably be called upon in the near future to vote upon a by-law to raise funds for a new street lighting system.

Redcliffe, Alta.—The Redcliffe Council has authorized the extension of the water service to supply several new factories and outlying districts. The cost will aggregate seven thousand dollars.

Port Credit, Ont.—The village council have desided to install a waterworks system. A by-law will be submitted to the ratepayers to authorize an issue of debentures to cover the cost of the work.

New Liskeard, Ont. — Following the recommendations to council some time ago by the fire chief regarding the department's equipment, an order has been sent in for additional fire-fighting apparatus.

Victoria, B.C.—The Industrial Committee will recommend that the sum of $4,000 be placed in the estimates as the year's salary of an industrial commissioner, the purpose being to advertise in the principal papers of Canada.

Victoria, B.C.—Sealed tenders will be received up to 4 p.m., Thursday, April 30th, 1914, for a semi-portable asphalt plant for the Corporation of the City of Victoria, B.C. Specifications may be secured from W. Galt, city purchasing agent.

Fredericton, N.B.—The city council at a meeting held on March 26 passed a resolution to secure legislation to issue debentures for the purpose of buying a motor-driven combination chemical engine, to cost $7,400, for the Fredericton fire department.

Dawson City, Y.T.—This city is preparing to install city-owned telephones, water, light and power plants. The civic league, composed of all political parties, is petitioning the Yukon Council now in session, for the necessary authority for the city to sell bonds to the extent of $200,000.

Port Hope.—At an enthusiastic meeting of the Board of Trade, held in the Town Hall here, recently, the following officers were elected: President, T. B. Chalk; vice-president, H. Fulford; secretary, Captain A. H. C. Long; treasurer, Edward Brown. The board is employing a commissioner in United States to secure factories.

Whitby, Ont.—At a special meeting of the town council, which was held last Friday, it was decided to go on with the establishment of a sewer system for the county town. The engineer, T. Aird Murray, was instructed to complete his plans and specifications preparatory to advertising tenders for sewers and disposal works estimated to cost about $100,000.

Ottawa, Ont.—The campaign on the question of the source of Ottawa's water supply terminated on March 30, when the ratepayers by a majority of 1,308 declared their preference for the Ottawa River water filtration mechanically as against the scheme of Sir Alexander Binnie to bring water from Thirty-One Lake in the Gatineau district. Over thirteen thousand votes were cast, 7,544 for the river and 6,236 for the Gatineau Lake scheme.

General Industrial

Winnipeg, Man.—A permit has been issued to a company, who will build a knitting factory.

Brussels, Ont.—C. Pope & Son, have leased a factory and will require machinery.

Forest, Ont. — The Thedford Fruit Growers' Association will build a fruit packing plant at Thedford.

Port Elgin, Ont.—W. A. Mitchell, fruit grower, has purchased a good-sized canning plant and moved it to this town.

Quebec, Que.—It is announced that the J. B. Blouin Co., manufacturers of boots and shoes, will move their plant to Sherbrooke.

Waterloo, Ont.—Permission has been given to advance a loan of $10,000 to the Quality Mattress Co. to assist in establishing a factory here.

Port Stanley, Ont.—The Port Stanley Mfg. Co., recently incorporated will take over the broom manufacturing business formerly operated by L. E. Lee and A. C. Wiley. The company is capitalized at $40,000.

Galt, Ont.—J. C. Dietrich, president of Shurly-Dietrich Co., states that his company is not seeking financial assistance from the town. The loss sustained recently at the fire will not exceed $100,000 over and above the insurance.

The Pas, Man.—A company, composed of local men, have applied for a charter to enable them to proceed to manufac-

ture and sell brick and sewer tile from clay deposits adjacent to this town. Mr. G. M. Brown is president of the company.

Moose Jaw, Sask.—It is reported that a company, with a capital of $200,000, will build a flax mill here.

Oakville, Ont.—The Glassco Fruit Preserving Co. will make an extension to their plant. The town will give them assistance.

Young, Sask.—A steam laundry will probably be established here. Mr. D. A. Berneche is president of the company behind the scheme.

Hamilton, Ont.—The National Natural Gas Co. are proceeding with the construction of their plant, and will lay several miles of pipe this year.

Melfort, Sask.—Olf M. Olson, of Volga, S.D., spent several days here during the past week looking over the situation, with a view to establishing a 250 or 300-barrel flour mill.

London, Ont. — Henry Botteri, of Schenectady, N.Y., who was awarded the contract for the fireworks display at the Western Fair this year, is planning the establishment of a large fireworks factory here.

Port Colborne, Ont.—Niagara Grain and Seed Co., Ltd., have asked for a fixed assessment of $10,000. The site selected for this compnay's building is west of the Maple Leaf Mills. The proposed building and equipment is to cost $200,000.

Winnipeg, Man.—The International Milling Co., with mills at Moose Jaw, Sask., and Calgary, Alta., as well as a number of points in the Northern States, is considering adding to its present plants in Canada.

London, Ont.—Ten thousand dollars' damage was done by fire to the Dominion Abattoir on March 25. The fire was confined to the stock house, which was almost completely gutted. The origin of the fire is unknown.

Galt, Ont.—The Shurly-Dietrich Co. is rebuilding the portion of their extensive plant recently destroyed by fire, with a loss of $200,000. The Board of Trade is negotiating with the company with a view to re-establishing larger works, conditional on due assistance from the town.

Nelson, B.C.—A local syndicate has arranged to build a plant with a capacity of a ton a day to demonstrate the possibilities of platinum mining in the Kootenay. A London metallurgist, who has been working on the experiments, is supervising the erection of the plant. R. M. McQuarrie is interested.

Regina, Sask.—Duncan B. Lea, of Chicago, representing a company, which will be known as the United Oil Co. of Western Canada, has been here looking over a site on which to erect a factory. The company will manufacture linseed oil and meal, but have not up to the present decided where to locate.

New Glasgow, N.S.—Work will be resumed at once by the Standard Clay Products Co., part of whose plant was recently destroyed by fire. The new factory, which was just completed, escaped the fire, and the operations of the company were not crippled to any extent. The plant destroyed will be rebuilt at once.

Wallaceburg, Ont.—It is stated that a large tract of land near the Dominion Sugar Co. plant has been secured by the Parke-Davis Medicine Co. and the Walkers, of Walkerville, and that a big factory will be built there at once for the manufacture of glass bottles.

Cambellford, Ont.—The Northumberland Paper and Electric Co., Ltd., have disposed of their interest in the pulp mill to the Seymour Power Co., who will operate it under the name of the Northumberland Pulp Co. The head office of this latter concern will be in Toronto.

Lindsay, Ont.—The Horn Brothers Woolen Co., Ltd., by-law carried on March 24 by a majority of 502. A very large vote was polled. Horn Brothers will be given a fixed assessment and will be granted $7,500. They will build a siding, erect new buildings and equip new plant.

Melfort, Sask.—G. A. McEwen, secretary for the newly-organized Canada West Grain Co., states that the first block of $40,000 of stock offered for public subscription has already been taken up. The company will shortly start operations on new elevators at Naisberry and St. Brieux, and possibly at Beatty.

St. John, N.B.—Bigelow & Hood, of Truro, N.S., manufacturers of aerated waters, who for some time past have been conducting a branch store on Main Street, have decided to open bottling works in this city. They intend manufacturing malto peptinized porter and several lines of soft drinks. Mr. J. P. Foley will manage the new factory, which will be located in the north end.

Walkerville, Ont.—A new company, which will manufacture metal polish, auto body polish, soaps, auto oils, etc., has just started business in the old malleable iron building, Walker Road. It will be known as the Coate-Green Co., and is composed of Messrs. J. R. Coate, D. Green, J. F. Petch and J. Coatsworth. For the present, two floors of the building, each about 100 x 40 feet in dimensions, will be occupied.

Sarnia, Ont.—Construction work on all parts of the Imperial Oil Co. refinery is being carried forward as fast as possible. The new acid house in the rear of the Pere Marquette round-house has been completed, and the boilermakers are now constructing a large number of tanks, which will be used to store the acid. The operations on the new plant, south of Clifford Street, have been proceeding steadily during the winter, and already the condensers for the new stills have been placed in position. Several large steel tanks are also under construction, while the underground storage tanks have been completed. The company is also putting down several large water mains, which will provide fire protection for the new plant.

Wood-Working

Wiarton, Ont.—The by-law granting a loan of $25,000 to the Canada Casket Company will be voted on this month.

Waterloo, Ont.—The Globe Furniture Co. has decided to build a large addition to its plant on Erb Street, at a cost of about $125,000.

Sarnia, Ont.—The new planing mill, which is to be constructed for the Lawrence Lumber Co., has been started, and the work will be pushed forward as fast as possible. The manager of the company was in Toronto few days ago purchasing machinery.

Edmonton, Alta.—Michigan lumbermen were here for the purpose of building at Willow River, what they claim will be the largest sawmill in the world. They say it will cut 100,000 feet daily. There is 300,000,000 feet of merchantable timber in the vicinity.

Stratford, Ont.—The Ruston Company recently decided to enlarge their planing mill on Milton Street. The work is now being proceeded with, Pounder Bros. being the contractors. The addition will be 40 feet by 87 feet, and will be situated to the west of the present mill, on property recently acquired by the company. It is to be of brick construction, two storeys high.

Orillia, Ont.—A by-law to loan J. R. Eaton & Sons, Limited, $50,000 for twenty years was carried on March 30, by a good majority. The vote stood: For the by-law, 720; against, 223. The by-law also provides for a gift of a ten-acre site and a ten-year fixed assessment. Eaton & Sons undertake to build and equip a sash and door factory and planing mill, with an appraised value of $100,000, on which the town is to hold a first mortgage as security for the loan.

Electrical Driving of Winding Engines and Rolling Mills*

By C. Antony Ablett, A.M. Inst. C.E. and H. M. Lyons, A.M.I.E.E.

Each inroad made by electricity into fields long held by the steam engine usually marks a distinct advance in engineering science. The authors show that the electrification of mine hoists and rolling mill machinery is not only fully as feasible as that of railways and other well-known applications, but that it has much greater flexibility in admitting of automatic control, safety devices, etc.

THE use of electrical machinery for driving hoisting engines in mines, and reversing rolling mill plants in steel works is comparatively recent; the first winders of importance having been introduced in 1902, and the first electrically driven reversing rolling mill being installed in 1906, though non-reversing rolling mills were driven electrically some eight or ten years earlier. The developments along these lines have been extremely rapid, as is shown by the fact that at the present time about one thousand large winding engines and nearly sixty reversing rolling mills are being driven electrically, and still greater developments may be expected in the future.

Under these circumstances a paper dealing with the modern aspects of the subject and giving the results of the experience obtained in the past would appear desirable.

The earlier winding engines were extravagant in power and had the disadvantage of drawing very heavily upon the source of electrical supply at the moment of starting. It was, therefore, impossible to use them on systems where the supply of current was limited, and even on comparatively large plants their use resulted in serious interference with other machinery. These disadvantages were, however, practically done away with whom the Ward-Leonard system and Ilgner's adoption of the flywheel to this system were introduced, but the last few years have seen greater improvements in the Ward-Leonard and the Ilgner system. The present paper will deal chiefly with the development of these systems by the various Siemens companies, who have installed about half the total plants in existence, and with whom the authors have the honor to be associated.

Ward-Leonard System.

A short description of the so-called Ward-Leonard system, illustrated in Fig. 1, is desirable as an introduction. In this system a direct current motor is used to drive the winding engine or rolling mill, the motor being supplied with power fro ma direct current dynamo. The essential feature of this system is that the voltage supplied to the motor, and consequently the speed of the motor, is controlled by controlling the field current of the generator, instead of by varying the resistance in the armature circuit of the motor. Thus, as the field current of the generator is increased from nothing to a maximum, the motor speeds up from standstill to full speed, and if the field current of the generator is reversed, the motor reverses its direction of rotation. The system enables a very exact control of the speed to be obtained, because the speed of the motor is practically proportional to the strength of the generator field, whatever the load on the motor may be, while with any control system where resistances are inserted into the armature circuit of the motor, the speed would vary within very wide limits with a change of load rendering the exact speed control quite impossible.

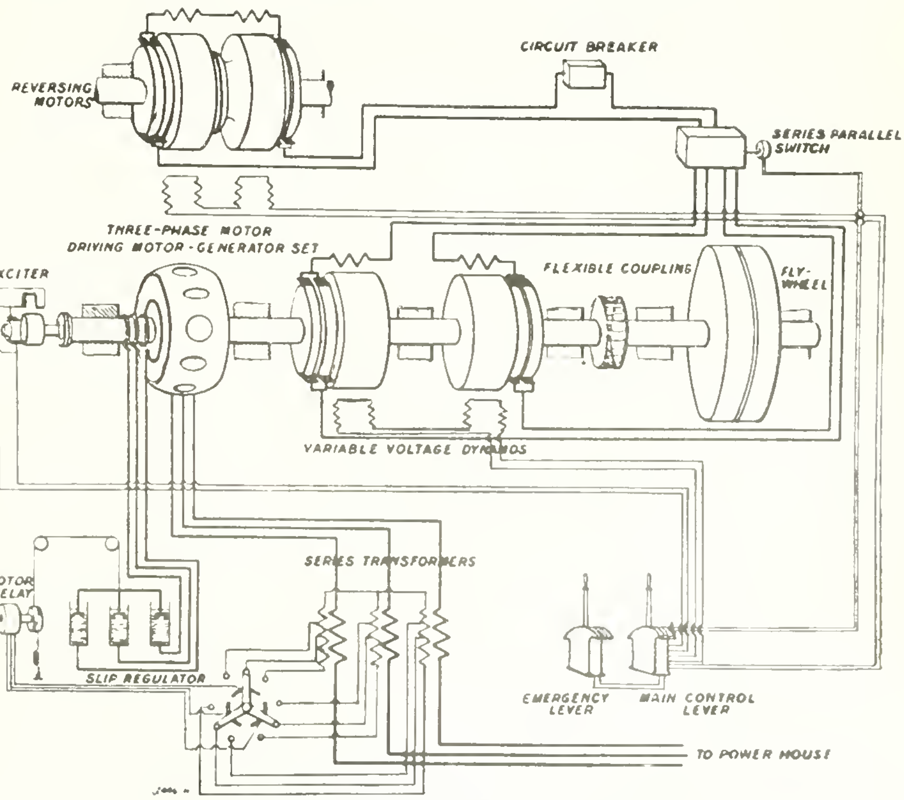


FIG. 1. DIAGRAMMATIC VIEW OF ILGNER SYSTEM OF DRIVING WINDING ENGINES OR REVERSING ROLLING MILLS.

The control of the dynamo field involves scarcely any waste of electrical power, but where resistances are inserted into the armature circuit, the loss of power may be, and usually is, very great. The field currents of the generator are small, so that the control mechanism is small, compact and very easy to handle; the armature currents are perhaps fifty times as great, so that any control mechanism which varies the resistance of the armature circuits is large, clumsy and difficult to handle, in fact a complicated relay system is often necessary to enable it to be handled at all. The dynamo used to supply the motor in the Ward-Leonard system is usually driven by a motor supplied from the available power circuit, forming a motor generator set, and this motor may be either direct current or three-phase, according to the power available. The dynamo may be and sometimes is driven by an engine, water turbine, or other prime mover, if this happens to be more convenient.

Application to Winding Engines and Hoists.

Speed Control. — The main control lever for operating the winding engine is coupled to the regulating resistance in the field circuit of the generator, so that

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*Abstract of paper read recently before the Canadian Society of Civil Engineers, Montreal.

when this lever is in the mid position there is no current in the generator field. As the lever is moved in one direction, the generator field current increases, and as it is moved in the other direction, the generator field current is also increased, but in the opposite sense.

From what has been said in the introductory remarks it will be seen that when the lever is in the mid position,

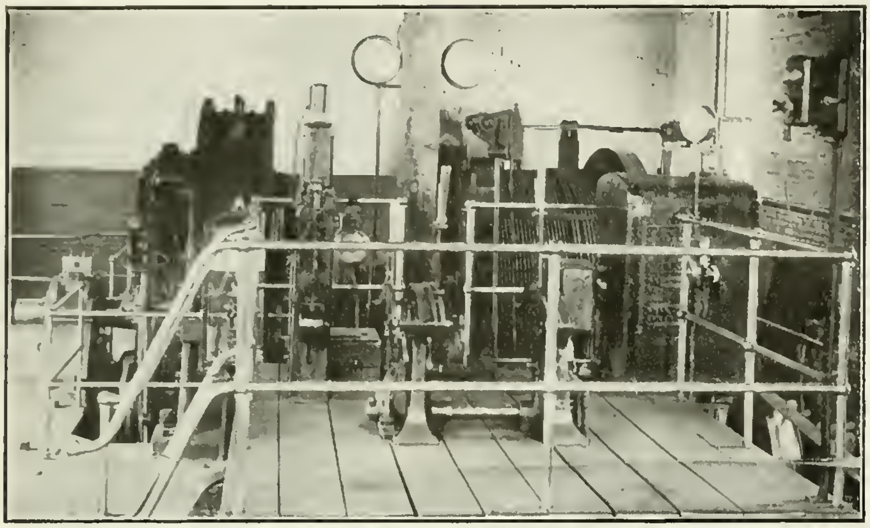


FIG. 2. WARD-LEONARD HOIST, LINGAN PIT, DOMINION COAL CO., SHOWING CONTROL LEVERS AND DEPTH INDICATOR.

the winding engine is at a standstill, and that it starts and speeds up as the lever is moved from the mid position in one direction, while, if the lever be moved from the mid position the other way, the winding engine increases in speed in the other direction, its speed being practically proportional to the displacement of the lever from the mid position, and not affected by the weight of material being hoisted. The driver has not absolute control over the speed, for two cams are provided on the depth indicator, one for each cage, which operate levers coupled to the control lever in such a way as to prevent the cages being accelerated at too rapid a rate, and to slow up the winding engine at the proper point so that the bank is approached at a crawling speed. Provided that these limits set by the cams are not exceeded the speed of the wind is entirely within the driver's control.

Use of Flywheel.

Fig. 4 shows the typical horse-power diagram for a winding engine. The inertia of the drums, cages, head sheaves, material wound, and the ropes, which altogether weigh about 60 tons in this particular case, necessitates a horse-power at the end of the acceleration period of each wind of 1865, which is about three and a half times the average power demand of the winding engine, in this case 524 horse-power, and it is found that the maximum acceleration peak is usually between three and four times greater than the average demand.

The consumption of energy for this Ward-Leonard control rises gradually during the starting period, and the maximum is only reached at the end of the time of acceleration, i.e., from ten to fifteen seconds after the start, because the speed of the winding motor is increased while it is giving the requisite turning moment by increasing the field of the generator, and consequently there is no loss of power in starting.

Since this acceleration peak is of short duration and only comes on gradually, it is possible to supply Ward-Leonard winders from power stations of comparatively small total output, provided that the machines in the power station have a sufficient overload capacity to maintain their speed during peak loads, as is usually the case with steam turbo-generators where the generators are provided with modern voltage regulators.

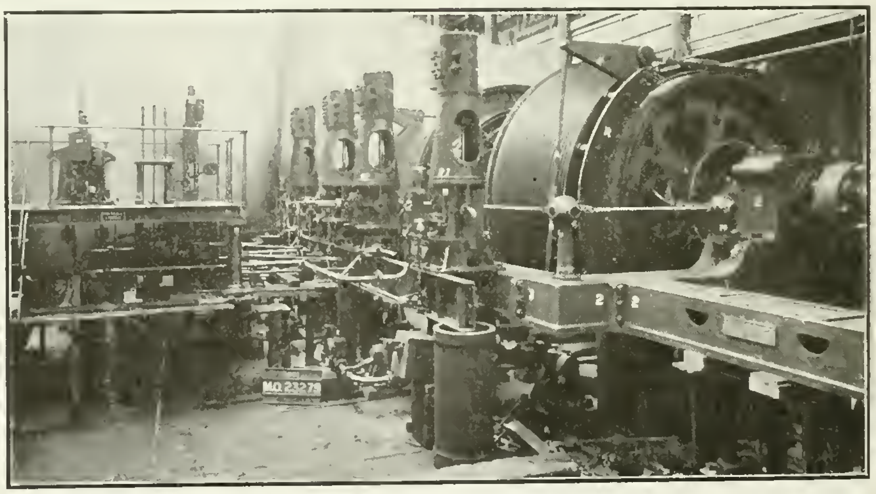


FIG. 3. CONICAL DRUM WARD-LEONARD WINDER, AT THE CANADIAN COLLIERIES COMPANY'S CUMBERLAND COLLIERY, SHOWING BRAKE GEAR AND CONTROL LEVERS. DEPTH, 1,000 FEET; NET LOAD PER WIND, 3½ TONS.

Where, however, this is not the case, and the acceleration peaks of the winding engine are large compared with the average demand on the power station, or where the winder is supplied through a long transmission line from a distant power station, it is sometimes necessary to couple a flywheel to the motor generator set. In this case provision must be made so that during a peak load the motor generator falls in speed, enabling part of the stored energy of the flywheel to be used to supply the heavy demand, and, when the load is small, the motor generator set is speeded up again, the surplus power being taken to restore the energy of the flywheel, so that the demand from the power house or supply system is maintained at about the average. This is the Ilgner system, so-called after the engineer who first used it in practice.

Fig. 5 illustrates the effect of the flywheel in equalizing the load taken by the winder. It will be seen that the current taken by the winding motor varies between +1900, and—1,000 amperes, while the current taken from the supply system is maintained practically constant at 400 amperes, the maximum voltage supplied to the winding engine and the supply voltage being the same.

The following example will give an idea of the power taken by the Ilgner system under practical working conditions with a winding engine arranged to wind 240 tons per hour from a depth of 1,960 feet, making as a maximum 44½ winds per hour, where the flywheel is used whenever the full output is being wound at the full speed, but where a lesser output is being wound at reduced speed, so that the acceleration peaks become less serious, the flywheel is uncoupled to save power. These results are conveniently expressed in terms of the kilowatts taken by the electric winding engine plant per shaft horse-power.

	Output tons per hr.	K. W. per S.H.P.
With flywheel	240	1.49
"	160	1.60
"	108	1.77
Without flywheel ..	160	1.35
" ...	108	1.48

It will thus be seen that, when working the winding engine on the Ilgner system, there is an increased loss of power of from 16% to 17%, as compared with the Ward-Leonard system, and, naturally with the latter where the flywheel is uncoupled, the resistances are cut out of the rotor circuit of the three-phase motor to avoid loss of power.

To avoid misunderstanding of the above results, it should be specially pointed out that shaft horse-power (S. H.P.) is taken to mean the actual work done in raising the load. i.e., if the actual weight of coal or ore, expressed in lbs., which is raised per minute be multiplied by the depth of the shaft in feet, and divided by 33,000, the shaft horse-power is obtained. The shaft horse-power thus does not include the mechanical friction of the winding engine, the sheaves, the guides or the rope losses, and the figure of the kilowatts divided by the shaft horse-power brings in the mechanical efficiency, as well as the electrical.

Details of Ilgner System.

Flywheels are usually designed to equalize the load by falling in speed from 15 to 20 per cent., and it is found that this entails a loss of power in the slip regulator of about 7½ per cent. to 10 per cent. The flywheel is usually coupled to the motor-generator set by means of flexible coupling, though in some very recent Ilgner motor generator sets, where there happens to be no advantage in running with the flywheel uncoupled, the electrical machines and the flywheel are arranged to be carried by two bearings only, reducing the first cost and the friction losses.

Of recent years, the capital cost of Ilgner plants has been greatly reduced, owing to the adoption of higher speed for the motor generator sets, and to the improvements in the manufacture of such flywheels, which enable them to run at very high peripheral speeds compared with those used in the earlier winding engines. For example, the provision of flywheel capacity to equalize peak loads of 60,000 horse-power seconds, in the early days of Ilgner winding, where peripheral speeds of 15,000 feet per minute were used, would require two flywheels of a total weight of about 80 tons, the friction and windage loss of which would be about 150 horse-power. Under modern conditions where the regular peripheral speeds are 27,000 and 30,000 feet per minute, a single flywheel of 22 tons weight would be used, instead of the two flywheels having a total weight of 80 tons, and the friction and windage losses would not exceed 100 horse-power.

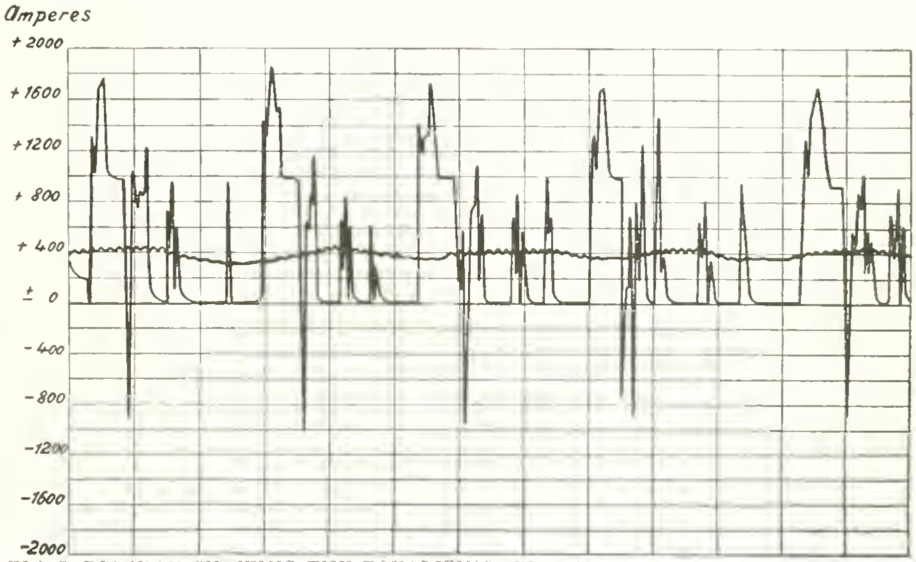


FIG. 5. DIAGRAM SHOWING THE EQUALIZING EFFECT OF THE FLYWHEEL ON ILGNER'S ADAPTION OF THE WARD-LEONARD SYSTEM. THE WAVEY LINE AT ABOUT 400 AMPERES IS THE CURRENT TAKEN FROM THE SUPPLY SYSTEM THE CURVE WHICH SHOWS THE GREAT VARIATIONS REPRESENTS THE CURRENT TAKEN BY THE WINDING ENGINE.

The Ilgner system was used on practically all the early European winding engines, but as at the present day, power stations are being installed of much greater capacity than those of a few years ago, and high speed turbo-generators of large overload capacity are being adopted, the Ward-Leonard system at the present time is being used to a much greater extent than the Ilgner system for winding engine work.

The Systems Compared.

Generally speaking, the Ilgner system of winding may be preferable to the Ward-Leonard system in the following cases:-

(1)—When the time occupied by the wind is short.

(2)—For vertical shafts.

(3)—For large outputs.

(4)—Where the winding speed is very high.

The above conclusions may be considerably modified by the nature of the electrical supply. Where the power station is small or the winder is supplied through a transmission line of considerable length, the Ilgner system will be more suitable, but where the power sta-

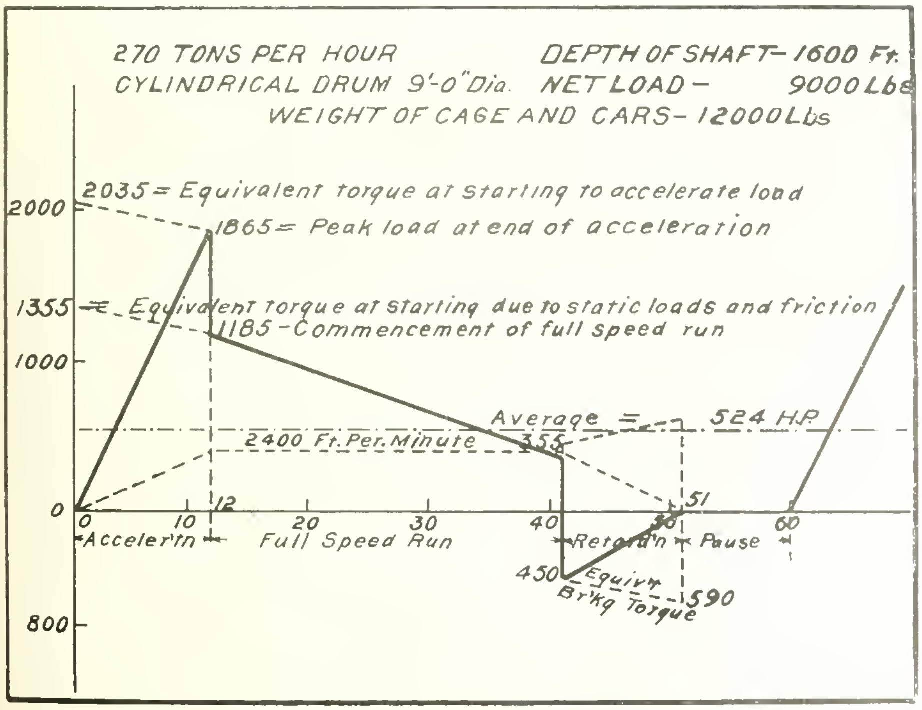


FIG. 4. TYPICAL POWER DIAGRAM FOR A WARD-LEONARD WINDING ENGINE.

tion is large and near the winder, the Ward-Leonard system is the better. Where there are a number of winding engines supplied from the same power station, the Ward-Leonard system would prove very suitable, because the combined effect of these winding engines working together will be to reduce the percentage of fluctuations on the power station load. Fig. 6 gives an illustration of this principle, and shows a case where three rolling mills are supplied from a single power station, and although the load of each one varies about 73 per cent., the total fluctuation in the power station load is about 28 per cent.

Brake Gear.

The mechanical brake is so arranged that, when required to be brought into action, it is actuated by a weight at the end of a lever, but normally held off the drum by an air cylinder. Under normal conditions the cams on the depth indicator actuate the control lever, so that the cages approach the bank at a very slow speed. When they reach the bank, the driver brings them to rest by means of his control lever, and then puts on the mechanical brake to hold the cages in position by means of the brake lever. The brake lever is interlocked with the control lever, so that the driver cannot put on the brake by means of the brake lever until the control lever is at about its middle position, i.e., unless the cages are moving at a comparatively slow speed.

To enable the driver to stop the winder in case of any emergency arising, a third lever, the emergency lever, is placed on the driver's platform and, if this be operated, it puts on the mechanical brake through the emergency gear and at the same time cuts off the excitation from the dynamo of the motor generator set.

Safety Devices.

From what has been said, it will be seen that the brake is applied by the positive action of the weighted lever, and, if the air pressure should fail, the brake is promptly put on. The armatures of the winding motor and the generator are permanently connected by heavy cables, and there are no cut-outs or switches in this circuit, so that the circuit between the armatures cannot be interrupted; electrical braking is always available as well as the mechanical brake, unless the excitation should fail.

As mentioned above, cams are provided on the depth indicator which keep the acceleration within safe limits, and the cage is brought gradually to a slow speed by the time it reaches the bank. An overwind device is provided, usually both on the depth indicator and in the shaft, which puts on the mechanical brake through the emergency gear and cuts off the excitation should the cage overwind the bank, thereby bringing the winding engine instantly to a stop. Should the air pressure or the excitation fail, the mechanical brake is put on by means of the emergency gear. When men are being wound the throw of the main control lever is limited by means of a switch on the bank, so that the winding engine cannot be run above a certain speed.

Where electrical driving is adopted, it is very easy to provide safety devices, and all those mentioned are designed to protect the plant against careless handling, but if the majority of safety devices were dispensed with, the Ilgner and the Ward-Leonard winder would still be better protected against careless handling than the steam winder. The fact that it is impossible for an Ilgner or a Ward-Leonard winder to race or run away makes it inherently safer than the steam winder.

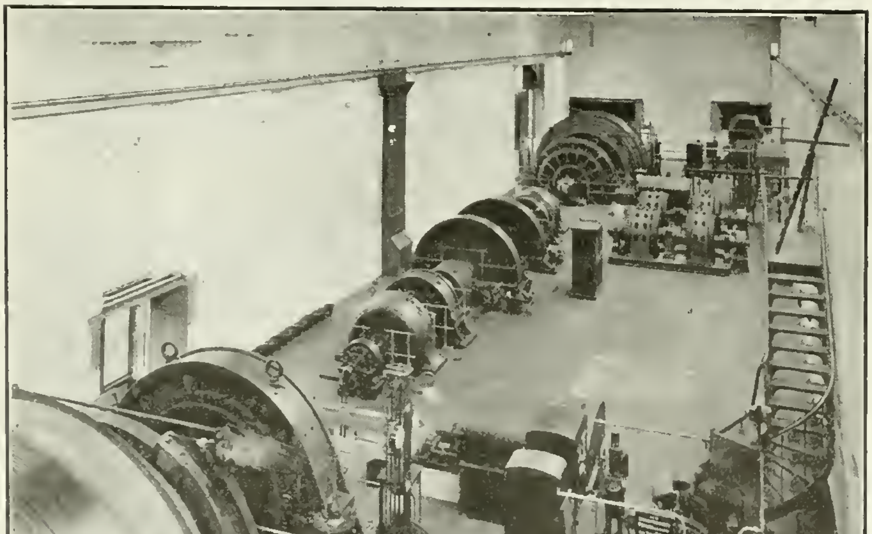


FIG 6. GENERAL VIEW OF WINDING ENGINE EQUIPMENT, MARKHAM STEAM COAL CO. PLANT, SHOWING BOTH WINDING ENGINES.

DOMINION ENGINEERING & MACHINERY CO.

EARLY in May, Vaughan Cowell & Co., of London, Englind, will bring out in that market an issue of probably $500,000 of Dominion Engineering & Machinery Co. preferred stock. This company is being formed with a Dominion charter to take over the old and well regarded Toronto concern, the Ontario Wind Engine & Pump Co., Ltd., which has been in business in Toronto since 1894.

The new company will be capitalized at $2,000,000, in equal amounts of cumulative participating preference stock, and common stock. The preferred stock will bear 7% and when the common has received an equal amount, the preferred will participate to the proportion of one-third to two-thirds in any additional surplus which may be distributed. The former directorate and management, will remain as before, the only addition to the board being the representatives of the London interests.

The business for purposes of valuation has been appraised by the Canadian Appraisal Company and the books audited by Thorne, Mulholland & Co., chartered accountants of Toronto. The company manufacture agricultural machinery, pumps, wind-mills, tanks, gasoline engines, etc. The new capital will allow extensions of business and incidentally repay bank advances and it is hoped that the previous output will be almost doubled.

The Ontario Wind Engine & Pump Co.'s balance sheet as at December 31, shows assets of $1,816,406, of which $614,000 is capital, and some $440,000 reserve accounts of various kinds. The company has borne an excellent reputation and if the same careful management is shown in the future there should be no change in this respect.

Safety appliances are important, but careful men are needed to prevent accidents.

Concerning the Supply and Erection of Machinery

The points dealt with in the accompanying article which appeared in a recent issue of the "Contractor," are just those often overlooked when signing some agreement involving either the supply, delivery and erection, or all three, of building material, machinery equipment, etc. The numerous and apparently increasing appeals to our law courts concerning the letter and spirit of contracts entered into, show that there is much slackness in formulating the initial understanding.

EVERY order for the supply and erection of machinery involves the creation of a contract of some kind between a person who may be termed "the employer" on the one hand, and a manufacturer on the other. It often happens that the employer has but little technical knowledge of the machinery which he desires to purchase. In these circumstances, if he be wise, he makes a stipulation that the machinery itself, the mode of erection and the efficiency of the plant shall be all subject to the approval of an engineer or other person nominated by him. If the work has to meet the approval of a skilled person, it is obvious that the manufacturer must pay close attention to the legal incidence of the contracts into which he enters. In the first place, he should be careful to have the contract put into writing. If the plant be for a municipal corporation or other local authority, he should insist upon the document being sealed; for although the seal may not be necessary in every case, it is always best to be on the safe side.

Contractor's Primary Duty.

Before agreeing to erect works of any magnitude, the contractor should make a careful examination of the premises and of the ground upon which the foundations of his engines are to be laid. To draw attention to this may seem superfluous; but numerous cases have arisen in practice where contractors, relying upon the specifications prepared by the employer's engineer, have made no tests on their own account. The result has been that the proper fulfilment of the contract within the limits of reasonable profit has been found impossible. Where a contractor undertakes to install plant of a certain specified power, he must fulfil his obligation to the letter. If he has undertaken to provide an engine of 10,000 h.p., it will not suffice to supply an engine of 9,950 h.p. That would not be a fulfilment of the contract, and so far from getting any portion of the contract price, the contractor might be compelled to remove the engine and pay damage for breach of agreement.

Supervising Engineer's Responsibility.

The employer's engineer, who is generally named in the contract, occupies a peculiar position. The contractor is entirely in his hands. Unless the engineer grants his certificate, which is usually required to be in writing, the contractor can recover nothing, nor can he sue the engineer for refusing to grant a certificate of approval. The only exception to this rule occurs in the case where it is proved that the employer and the engineer have fraudulently agreed to withhold the necessary certificate. In such a case, the contractor would have a right of action against both the employer and the engineer. It should perhaps be mentioned, for the comfort of the contractor, that the employer is also bound by the decision of the engineer upon any matter which is left to his decision by the contract. He may not like the look of the work when completed; he may imagine that the output of power, or that the working of the machinery, is unsatisfactory, but he is bound by the engineer's certificate.

The engineer is, however, not altogether immune. Thus, if it be his duty to supervise the work in the course of erection, and to see that the contractor uses proper materials, he may be held liable to the employer for negligence in allowing the contractor to evade his obligations. For instance, suppose that the foundations for a generating plant were to be laid in concrete mixed in certain proportions, the concrete to be approved by the engineer. If, after the completion of the work, the foundations gave way owing to the use of material which did not comply with the specification, the engineer might be held liable for negligence.

The Extras Feature.

In addition to the power of approving the work, the duty of making allowances for extras is often entrusted to the engineer. Close attention should be paid by the contractor to this question of extras, for it is probable that there never was a contract yet in which some question did not arise on this head. Unless the contract provides for extras, the contractor may find himself doing extra work at his own cost. For instance, if he has to erect plant complete for a lump sum, and he finds in the course of erection that the addition of some further piece of apparatus or the use of more expensive material would be an improvement, he could not recover the additional cost if he incurred it without authority. As a rule, however, the question of extras is left to the engineer; and here it is desirable to warn the contractor of the necessity for seeing that power to allow payment for extras be expressly conferred upon the engineer by the contract between the parties. Unless the employer has entrusted that power to the engineer, he cannot be held liable for anything which the engineer may order.

Set Date of Completion.

Nearly every contract contains a provision that the work shall be completed by a certain time, the contractor being subject to penalties in case of default, or in some rare cases entitled to a bonus in case of expedition. Time is of the essence of a contract of this kind, and the contractor is in danger if he fails to perform it to the letter. As a rule, however, the question of time is also left to the discretion of the engineer, power being conferred upon him to give more time if he thinks fit. The contractor should take care to see that the contract contains a clause to this effect, for the engineer cannot extend the time unless specially authorized to do so.

Failure to erect machinery within the specified time may lead to grave consequences for the contractor. In one case the defendant agreed to fit up and complete machinery for the plaintiff within a reasonable time, but failed to do so. It was held that the jury, though not bound to assess the damages at the amount of profits under a contract with a third party which the plaintiff was prevented from earning, yet might do so if they were satisfied by reasonable evidence that the plaintiff would have earned these profits if not prevented by the breach of contract.

Guarantee Period of Maintenance.

Many contracts for the erection of plant contain clauses providing that it be maintained in good working order for a prescribed period. The contractor should take care to make it a condition of his liability that the plant should be carefully handled, and that it be operated by experienced workmen. As an instance of the immense burden which a maintenance or repairing clause may place upon a contractor, reference may be made to a case where there was a covenant to build a bridge in a substantial manner and to keep it in repair for a certain time. The bridge was broken down by an extraordinary flood. It was held that the contractor was liable to rebuild it.

In such a case, however, it will not be allowable for the employer to remedy defects without giving notice to the contractor, and letting him have the option

of doing the work himself. For instance, in an American case a contractor agreed to build an elevator under contract, which provided that if, after trials there was any "deficiency in the working of any of its parts, such parts shall be removed and replaced with new and acceptable work." The elevator was not of the stipulated capacity, so the employer, without giving notice to the contractor, spent money on it to put it right. It was held, however, that he could not recover the sums so expended from the contractor.

Power Supply Contract.

Having dealt with the general aspects of contracts for the erection of machinery and plant, it remains to consider certain points which may arise in special cases. Thus, suppose there is a contract to supply power, what are the obligations of the party supplying it? In one case the plaintiffs agreed to become tenants of a room in a factory in which there was an engine, which was used to operate machinery in the building, including a machine in the room let to the plaintiffs, and the defendants agreed to supply power for the working of that machine.

The question was whether the defendants were liable for an accident to one of the plaintiffs' workmen. The accident arose from the power which worked the plaintiffs' machine doing so in so violent a manner, and at such velocity, that the drum of the machine burst, and a workman was killed by being struck by one of the pieces. As employers, the plaintiffs were liable to pay compensation to the widow of the workman, and they brought an action to recover as damages the sum which they had to pay. It was decided by the Court of Appeal that the obligation of the defendants to supply power did not arise upon a demise, but upon a specific contract, which, in the absence of special conditions, involved that the power supplied should be reasonably fit for the purpose required, and that the defendants were liable for the consequences of a breach of that contract.

Where, as frequently happens in the case of a tenement factory, the owners of the factory supply power from a central plant to a large number of independent manufacturers, they would do well to consider the advisability of so limiting their liability that they cannot be sued for the damages caused by the main engines racing or by other accident.

CANADIAN PIG-IRON OUTPUT IN 1913.

THE production of pig iron in Canada in 1913, as shown by figures collected by the Bureau of Statistics of the American Iron and Steel Institute, amounted to 1,015,118 gross tons, against 912,878 tons in 1912. Of the 1913 total 986,848 tons was made with coke and 28,270 tons with charcoal, coke and electricity. The numbers of furnaces in blast in Canada at the close of 1913 was 10, of which 6 were in Ontario and 4 in Nova Scotia. Seventeen furnaces were active at some time in 1913.

The production of basic pig iron in 1913 was 558,524 tons against 489,799 tons in 1912; of Bessemer pig iron, 227,662 tons against 228,742 tons; of foundry pig iron and ferrosilicon 225,231 tons against 194,208 tons; and of malleable Bessemer and white and mottled pig iron, direct castings, ferrotitanium, etc., 3701 tons last year against 129 tons in 1912. The 1,000,000-ton mark in pig-iron output was crossed for the first time last year.

Two new blast furnaces were under construction at the close of 1913. Of the 22 completed furnaces 17 usually use coke for fuel and 5 use charcoal. Two new coke furnaces were added in 1913: one 20 x 85 ft., blown in May 22, belonging to the Dominion Iron & Steel Co., Sydney, N.S., and the other at Port Colborne, Ontario, 19½ x 85 ft., belonging to the Canadian Furnace Co., Buffalo. The Standard Iron Co., of Montreal, completed a charcoal furnace at Parry Sound last year. It is 12 x 60 ft. and was first blown in on August 22.

RECENT MOLDING MACHINE ACHIEVEMENTS.

A WESTERN manufacturer of molding machines is authority for the following interesting comparison of costs on several pieces of foundry work, as made up by hand and by machine.

The first job mentioned was a rub iron for wagons. This work had formerly been done by hand, 4 pieces on a gate. The average production was 70 molds per day, or a total of 280 pieces, at a cost of $3.30. The pattern for the machine was arranged to cast 6 pieces on a gate, and the production was increased by the use of the molding machine to 116 molds, or 696 pieces. The cost of producing the 696 pieces was only $3.48, or a total increase of 18 cents, for which an increase of 416 pieces was secured. This represents a reduction of nearly 60 per cent. in cost.

A second job was the molding of a small sprocket wheel, the production of which, on the bench, ran from 12 to 15 molds per day. This production was increased to 90 molds per day at a cost of 4c. per mold; each mold required the setting of 4 cores and 2 steel shafts.

A third instance was that of a door shoe, the average production of which was about 60 pieces per day on the bench. This job required the setting of 12 cores in each mold, but the daily production on a machine was so largely increased that it ran up to 260 pieces.

In the production of large sprockets and hand wheels for road scrapers, the use of a combined air squeezer and jolter machine increased the output from 15 molds per day, at a cost of 22c. per mold, to 70 molds per day, at a cost of about 6½c. per mold.

These records are of comparatively recent making, and go far to indicate that almost any foundry still offers a field in which the manufacturer may find opportunity for lowering his costs by the adaptation of his work to the proper type of molding machines.—Iron Age.

TRADE DISPUTES DURING MARCH.

A CONTINUED decrease in time losses through trade disputes was reported to the Department of Labor during March, as compared with the previous months of the year. The number of disputes was also considerably smaller than that of the corresponding month of last year.

Seven disputes resulting in time losses of 32,618 working days were in existence during March, as against fifteen disputes and 68,285 working days lost during the same month last year. The first three months of the present year have been very favorable from the standpoint of industrial disputes. Eight new disputes occurred in this period, resulting in time losses of 4,205 days.

During the corresponding period of last year twenty-one strikes were reported, the time losses resulting from these up to the end of March being 29,246 days.

Five hundred and thirty-seven employees have struck work or otherwise been involved in trade disputes during the first three months of 1914. This compares favorably with the corresponding period of 1913, when 4,511 workers were affected by strikes and lockouts.

Rail Production.— Rail productions and pig iron statistics for 1913 have been announced by the American Iron & Steel Institute. The output of all rails totaled 3,502,780 tons, an increase of 174,865 tons over 1912. In 1906 — the maximum—the aggregate was 3,977,887 tons. Open hearth rails more than doubled those of Bessemer manufacture; the former process showing an increase of 20 per cent., compared with 1912. Pig iron produced totaled 30,966,300 tons, an increase of 1,239,360 tons over the previous year. In Canada 1,015,118 long tons were made, an increase of 102,240 tons.

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

BLANKING, FORMING AND BENDING DIES.

By S. Craig.

THE accompanying cut Fig. 1 shows a simple form of compound die that could be easily fitted to almost any kind of a press. The punch part (3) consists of a blanking punch and a forming die (7), while the die contains the blanking die (4) and the forming punch (8). The stock is sheet brass .020 inch thick and is formed as shown at 1.

The tension pieces (BB) are of case-hardened machine steel and are kept flush with the top of the die by the pins (CC), the plate (F), and the supporting springs as shown. The piece (9) is also of machine steel and is fastened to the die with flat-headed screws. Its principal use is to hold the forming punch (8).

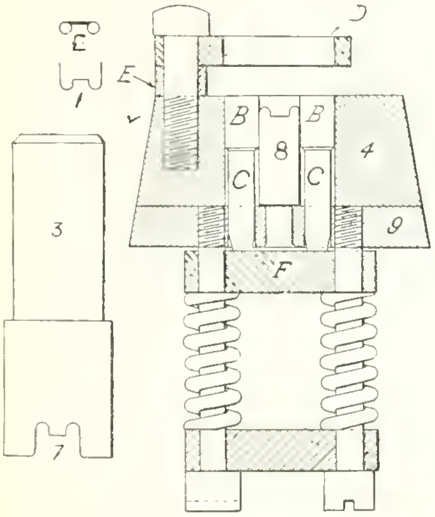


FIG. 1 BLANKING AND FORMING DIE

A separator piece (E), supports the stripper (D) at the right height, and also acts as a guide to the stock. The blank is cut by the die (4) and the outer edges of the punch (3) which also forms the piece over the die (8). The tension pieces (BB) serve also as a stripper to remove the formed piece from the die.

Second Operation.

The second operation consists in wrapping the formed blank around the wires shown at (A) Fig. 2. This is accomplished by a simple curling die shown in the same figure and which explains itself. The two wires (GG) are laid in the grooves already formed in the brass blank and the whole is placed upon the die (5). The punch (6) curls the metal tightly around the pins forming the completed assembly (A). The above dies involve many principles of good practice and, with the addition of a few automatic feeding devices, could be economically used for the production of large quantities.

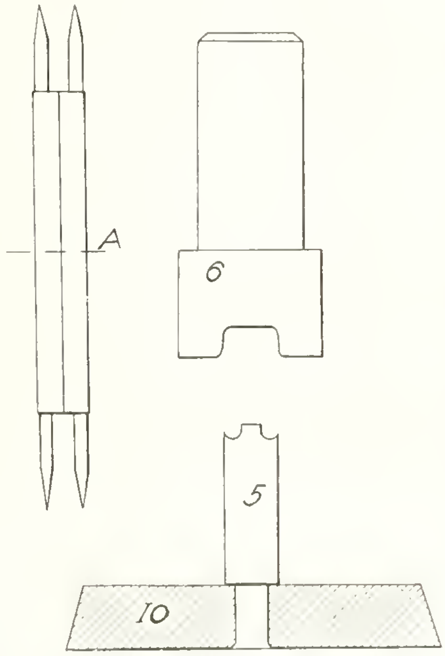


FIG. 2. DIE FOR CURLING OPERATION

Compound Bending Die.

The die Fig. 3, was designed and successfully used for forming the piece (R) into the clip (P) to be used in the manufacture of ladies' belts. The body of the die (I) is made of cast iron. The machining on the sides and bottom was done in the shaper in the usual way. The beveled forming slides (AA) were cut at an angle of 37° with the base by means of a 60° end mill in the milling machine, and were made wide enough to allow for a one-eighth inch gib (J).

Two holes were bored and reamed for the two fillister head screws (GG) which support the plate (F). A hole is also bored and tapped for the stud as shown. The plate (H), supported by the spring (J) is countersunk to take the heads of the screws (GG). Both screws and plates are of machine steel and case-hardened. Two holes are drilled and clearance cut at (OO) for cams (DD). The slides (AA) are held in place by the grub screws (UU), and, at (KK), holes are worked at the necessary angle to slide nicely over the cam pieces (DD). At (NN) the slide is shaped to give the desired bend to the piece (P). The punch holder (E) is of machine steel turned, bored for the punch (C), and milled to fit the cam pieces (DD). These cam pieces are case-hardened and are held in place by four taper pins. A screw (Y) whose point fits in a slot in the punch, prevents it from turning round and misplacing the forming piece (B) which is fastened in a slot in the end of the punch.

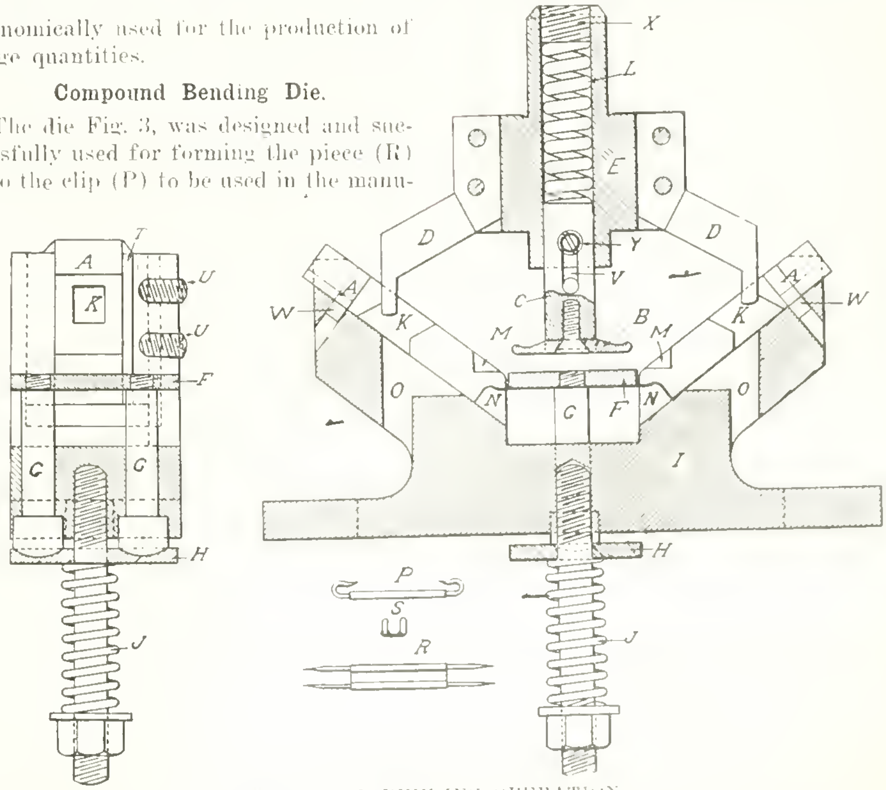


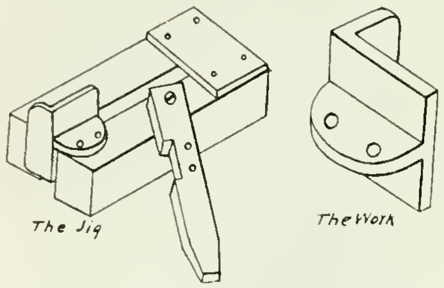
FIG. 3 DIE FOR BENDING OPERATION

The piece (R) to be formed is placed on the plate (F) and located by the depressions (MM) in (AA). As F is depressed by the punch, the ends of (R) are bent up at right angles and when (F) bottoms and the spring (L) is compressed, the ends are bent to the proper form over the ends of the plate (B) by the parts (NN) of the rams (AA). As the punch is withdrawn, the rams (AA) are drawn away by the top sides of the cams (DD), and the formed piece is easily removed from the plate (B). No tool steel was used in the construction of this die, case-hardened machine steel being found to serve fully as well. All case-hardening was done with prussiate of potash, which in our experience gives the best results and is not nearly as poisonous as the cyanide of potassium.

THE JIG THE BLACKSMITH MADE.

By D. A. Hampson.

WORK was not very brisk in the blacksmithing line and when our smith had dressed up the last lot of tools he approached me for another job. There was plenty to be done in the machine shop so I said, "There is a barrel



JIG THE BLACKSMITH MADE.

of castings by that drill down in the south corner, I'll show you what to do with them. You see those depressions in the castings? Well, run a ¼-in. drill through all of them. There are also two holes of the same size to be drilled in the flange. I'll give you a templet, by which you can lay them out with a seriber and centre punch. If you can find a better way, go to it." With this, I left Johnson, well knowing that the job would get done without his being watched.

It was some time along in the next afternoon before I got round to where the castings were being drilled. I found all the "spotted" ones finished as well as a good share of the holes in the flanges. Johnson was surely working, but was he drilling to circles and punch marks? No sir. He had before him a quick loading, accurate and non-destructible jig of simple though wonderful design. Rough it was but it was doing its duty satisfactorily and what more was wanted?

The jig shown in the sketch was made almost entirely of scrap and is self-explanatory. It consists of two bars of iron fastened in the correct relation to each other by the plate as shown. The piece was located by the slot in the swinging handle by which it was also held in place. The guide holes were simply drilled in the handle and case-hardened. The whole fixture had taken little more than an hour to make and the old reliable Johnson worked away realizing only that he had saved himself considerable tedious work.

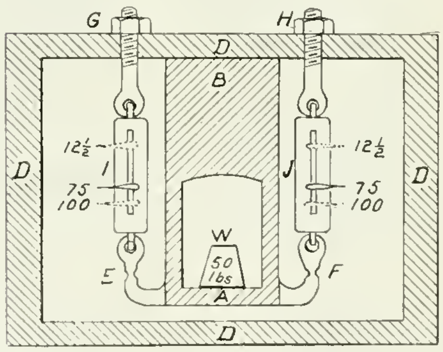
TENSION ON CYLINDER COVER STUDS.

By J. G. Smith.

I HAVE read with interest the debate on "Tension on Cylinder Cover Studs," and would be pleased to see such educational discussions come up oftener in your valuable journal. I give the following as my explanation and will be much gratified if you can find space to publish it.

Referring to the sketch (AB) is a tray, containing an aperture to hold the weight (W), and arranged to press against frame (D). Supporting arms (E) and (F) are so reduced that they will break under a load of 100 pounds. These connect to the frame (D) (D) through the spring balances and bolts as shown. The weight of the tray without the weight (W) is 25 pounds. Now, if the nuts (G) and (H) be screwed up until the pointers on the spring balances register 75 pounds each, the tray (B) will be forced against the frame (D) with a pressure of $75-12\frac{1}{2}=62\frac{1}{2}\times2$ or 125 pounds. Upon adding the weight (W), the indications on each scale will be $12\frac{1}{2}+6\frac{1}{2}+25=100$ pounds, which is the breaking load of (E) and (F).

Supposing the pointer to have moved through a distance of 2½ inches when



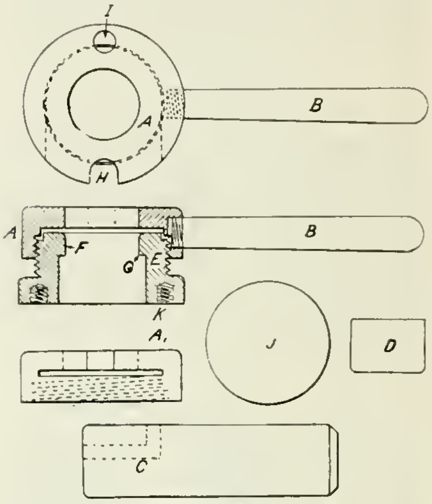
TENSION ON CYLINDER COVER STUDS.

registering 75 pounds, the addition of the extra weight (W) will have caused (B) to recede from (D) one inch before the members (E) and (F) fail. This imaginary experiment proves to my mind that the theory advanced by Mr. Rogers is correct; that is, when steam or any other pressure is applied to a cylinder head, an immediate stress is put on the studs that support it.

CHEAP DRAWING DIE.

By S. Craig.

THE die herein described involves some principles that could be utilized for a multitude of small jobs in the shop of limited tool capacity. It was made for drawing the cup (D) from the blank (J) in one operation. The mate-



CHEAP DRAWING DIE.

rial was sheet copper about .020 inch thick. As there were not many of the cups required, the material used for the dies was machine steel and, after completion, the parts were case-hardened and mounted in a foot press.

The piece (E) or die proper was turned, bored, threaded and counterbored at one setting from stock of the right diameter. Two holes were drilled and tapped in the base (K) for the purpose of fastening the die to a bolster which was counterbored ¼ inch deep to receive it. The piece (A) or tension ring was turned up in the same way from the same bar of stock. The hole (I) is for the purpose of observing the position of the blank and the part H is cut away for convenience in pushing it in place through the slot, which is better shown at A. A hole was also drilled and tapped to receive the handle (B).

In operation, the blank (J) was pushed through the slot in (A) over the top of the die (E). The handle was then pulled towards the operator against a stop so adjusted as to give the required tension to prevent wrinkling of the material. The drawing operation was accomplished by the punch (C) and the stripping is automatically done upon the withdrawal of the punch by the edge of the counterbore shown at (G). The hole in (C) shown by the dotted

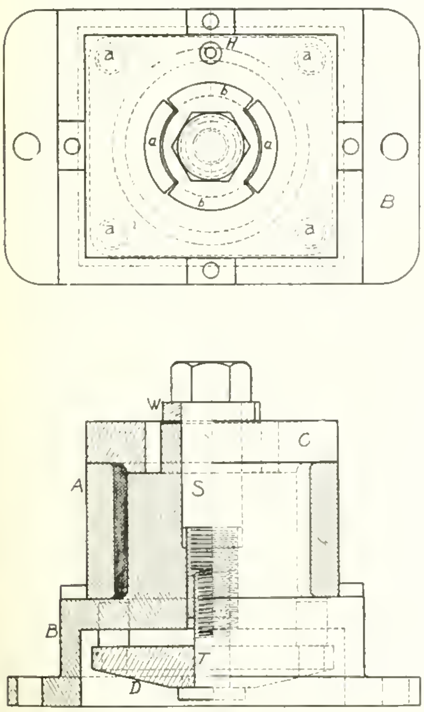
lines was drilled for admitting air and thus facilitating the stripping of the cup from the punch.

A BABBITTING FIXTURE.

By A. L. Loy.

THE fixture shown in the two accompanying cuts was designed for babbitting the malleable iron casting (A) which is used on the crank-shaft bearing of a gasoline engine. To distinguish it from parts of the fixture, the bearing is shown in section on both sides of the drawing. The base (B) of the fixture is turned to form the arbor about which the babbitt is poured, and also gives the fillet at the bottom. The top piece or cap (C) gives the fillet at the top and drops down over the central portion of the base (B), which does not quite extend through (C). The piece (C) is cut out, as shown at (aa), so that the lips (bb) of the washer (W) will drop through when turned around to correspond. As shown in the cut, these lips extend out over the cap and clamp it to the base (B).

The stud (S) is threaded at the lower end into the base, besides being tapped out for the screw (T), which is provided with a large head for holding the piece (D), being fastened solidly to the same to prevent turning. At the corners of the plate are the ¾-inch pins (dd) which extend up through the base near the corners of the piece to be babbitted.



BABBITTING FIXTURE.

A slight clearance is allowed between these pins and the casting when in the lowest position, in order to allow the washer to be released.

It will be noticed that the stud (S) is threaded into the base (B) with a left-hand thread of ⅛-inch pitch, and is tapped out for the screw (T) with a right-hand thread of the same pitch. After the piece (A) is babbitted, the stud (S) is turned slightly in a clock-

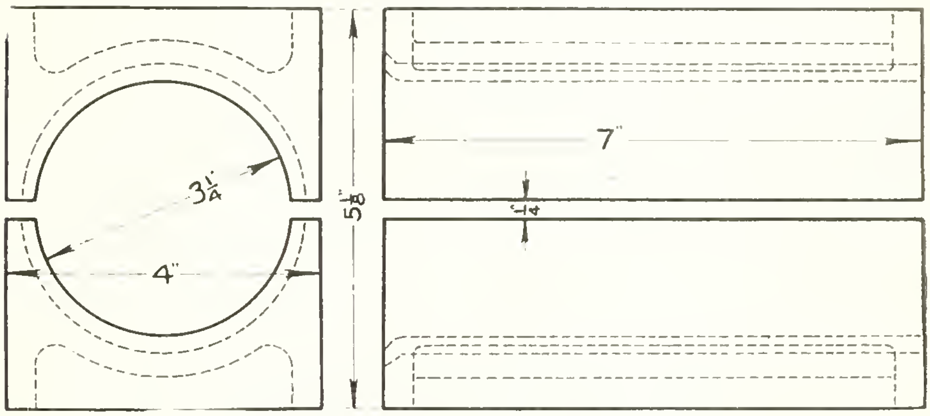


FIG. 1. BEARING SPLITTING AND BORING FIXTURE.

wise direction, thus loosening the washer (W), which is then turned so that the cap (C) may be lifted off. A further motion of the stud (S) in the same direction causes it not only to rise itself, but, due to the internal threads, to pull up the piece (D) at double the speed; the two threads acting in the same direction. The arbor is turned with a 1/32-inch taper, as these bearings are afterward bored to size. These pins lift the bearings about three-eighths of an inch on the arbor, sufficient so that it may be readily removed.

The casting (A) has previously been finished on all six sides, and is centered by steel pieces on the base. The babbitt is poured through the hole (H). This fixture is extremely quick-acting owing to the combination of the two screws, and is very simple in operation, as no trouble was experienced in getting these bearings off the arbor, enabling them to be turned out in a rapid and efficient manner.

BEARING SPLITTING AND BORING FIXTURES.

By D. S. Mann.

FIG. 1 shows a bearing used on a gasoline engine. It is a malleable iron casting with babbitt lining cast in. Two halves of the bearing are cast as one piece, and, after being babbitted and otherwise machined, are parted with ¼-in. milling cutter on either side. Shims are then used in this space to obtain the adjustment of the bearing. The casting is machined on all four sides and the end, but, as this is ordinary milling machine work, the fixtures used are not shown. The bearings are babbitted on a solid arbor, which is 1/32-in. small, and the bearings are then reamed or bored to size on the fixture shown in Fig. 2. This work is done in a radial drill press, the fixture being clamped on the edge of the table. The bearing is held between two shoulders at the side, and rests upon ½-in. pins at the bottom, while two ⅝-in. capstan screws hold the bearing in place, these being located in a cross-bar which drops over the necks of two 1⅛-in. steel posts. The bar is slotted large enough so that it can be readily picked off and dropped into position. A fixed bushing is placed at the bottom, while a removable bushing is

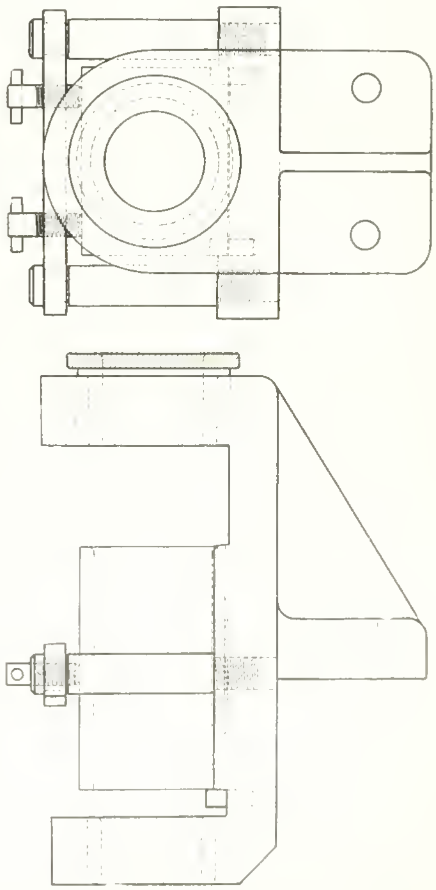


FIG. 2. BEARING SPLITTING AND BORING FIXTURE.

used at the top, being located in another fixed bushing.

Perhaps the most interesting part is the boring bar shown in Fig. 3. This

bar is deeply grooved at the lower end, so that the babbitt chips do not interfere with its operation. The bar is 2¾ in. in diameter, and is slotted out for a steel block ⅝ in. thick, in which are located the two cutting blades, these being of high speed steel 5/16 in. thick and ½ in. wide. They are placed at an angle of 60 degrees to the axis of the bar, and are backed up by ⅜ in. adjusting screws. Each cutter is held in place by two hollow set screws through the bar itself. The steel block carrying the cutters extends out ⅛ in. on each side of the bar, this being sufficient to catch the removable bushing at the top.

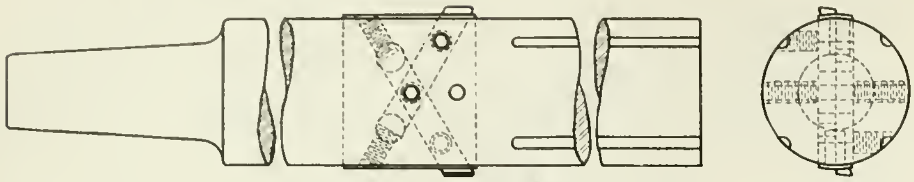


FIG. 3. BORING BAR

After one of the bearings is finished, the spindle of the press is simply raised and the removable bushing is caught on the projecting block in the bar and lifted out of the fixture. Holes are drilled through the steel block at the ends of the plate for the adjusting screws. After being bored, the bearings are split on the fixture shown in Fig. 4.

The body (A) of the fixture is bored out to receive the arbor (B), which extends through the body, being provided with a plate (C) at the one end, which also carries two bushings for indexing, and at the other end a steel plate held by cap screws. An index pin is located at the side of the body, and is operated by a small pin which is driven into the index pin. The index pin is fitted at the back with a heavy spring.

The plate (E) at the left side is for the purpose of squaring up the bushings automatically, so that it is only necessary to slip them on the arbor and drop the slotted clamp (D) across the end. The ¾-in. stud is placed in the end of the arbor, and the top and bottom of the threads are milled off to ⅝ in. thickness. The bar (D) is also slotted ⅝ in., so that it will not turn when slipped over the stud. A ¼ in. by 4 in. milling cutter was used for parting the bearing.

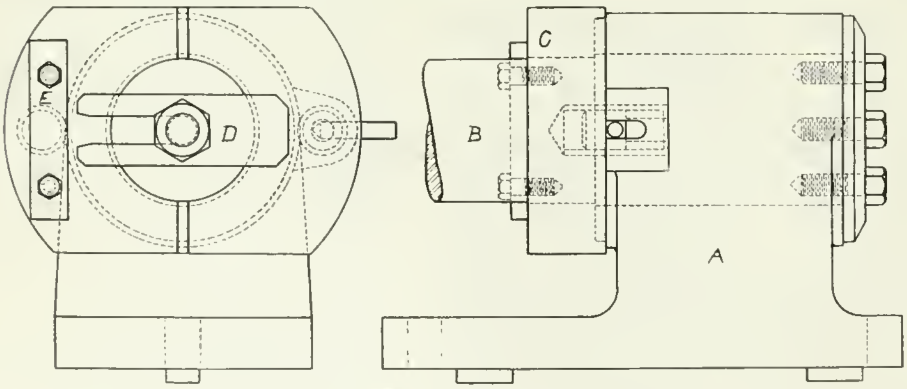
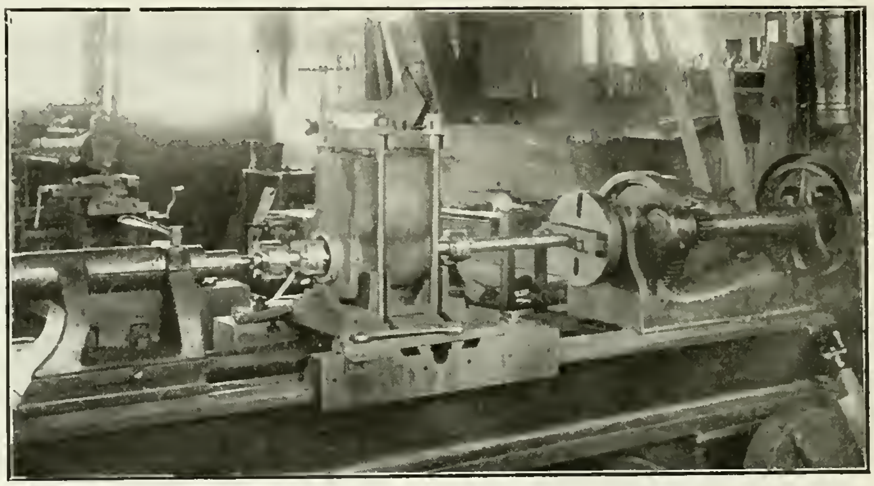


FIG. 4. BEARING SPLITTING FIXTURE.

BORING CYLINDERS.

By D. O. Barrett.

THE photo shows a method used in boring hopper-cooled gasoline engine cylinders. These particular cylinders ranged from 4 to 6-inch bore, in six sizes, there being three sizes per set; that is, 4, 4½ and 5-in. bore cylinders had the same outside dimensions, while the same was true with the 5, 5½ and 6-inch size. The two sets had, of course, a different stroke. Only two fixtures were then necessary for the six cylinders.


BORING CYLINDERS.

The cross slide was removed, and the fixture shown was clamped and doweled to the carriage. The vees of the fixture were supplied with hardened jaws on each side, while a shoulder at the end took the thrust, having an adjustable stop for locating. Four bolts were used for clamping, the top cross-bar being provided with a hinged piece, which touches the cylinder on either side, thus equalizing the pressure and minimizing any liability to distortion. A flat was milled on each side of the boring bar at the end, and was driven by the slotted bar attached to the face-plate. This equalized the driving strains, so that there was no tendency to bend the bar. Two roughing and one finishing cut was taken through the cylinders. The three cutter heads were placed on the bar at the head end in the order in which they were to be used, and were driven by means of a pin through them and the bar. None of the cutters were removed until the cylinder was entirely finished, when they were all at the other end of the bar. The blades were set at an angle of about seven degrees, and were held by taper pins, the bodies being of steel. After being bored, the cylinders were placed on a stub arbor and the ends faced.

Concrete Hardening Material. — A concrete hardening material now being introduced contains 95 per cent. iron dust or iron flour, which is mixed with cement for finishing the surface of concrete floors. From 15 lb. to 25 lb. of the material is mixed with 100 lb. of the cement while dry, and one part of this mixture to two parts of sand makes the slurry for the top coat, which varies from ½ in. to 1 in. in thickness. It is said to make a hard and durable floor, waterproof and not slippery. The hardening material is used also to make new concrete adhere to old concrete in repair work.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

Doubtless some of the elementary work in the first few articles of this series may appear more or less superfluous, but it must be remembered that numerous simple rules and formulae appear from time to time in Technical Journals, which are discarded and dubbed impractical by many operators for the simple reason that the elementals are either unknown or have been forgotten. The purpose of this course will have been achieved if the above tendency is even in part combatted.

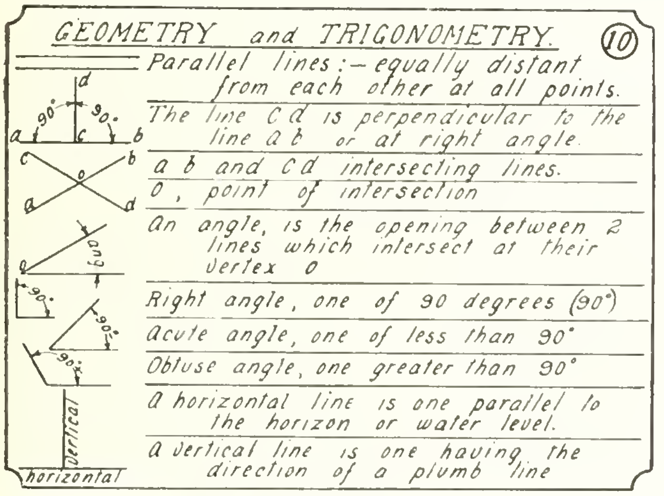
GEOMETRY.

Geometry is that branch of mathematics which treats of the properties of lines, angles, surfaces and volumes.

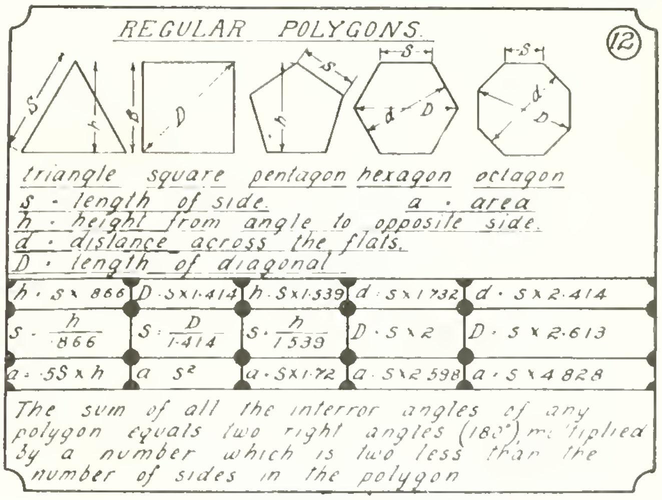
A point indicates position only; it has neither length, breadth nor thickness, while a line has only one dimension—length.

Parallel lines are equally distant from each other at all points, and a line is perpendicular to another when it meets it and forms two angles of 90 degrees each.

A horizontal line is one parallel to the horizon, or water level.

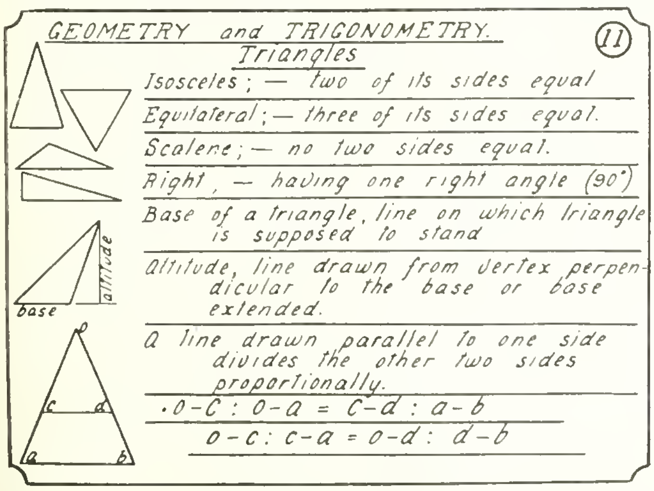


ARITHMETIC CHART 10.

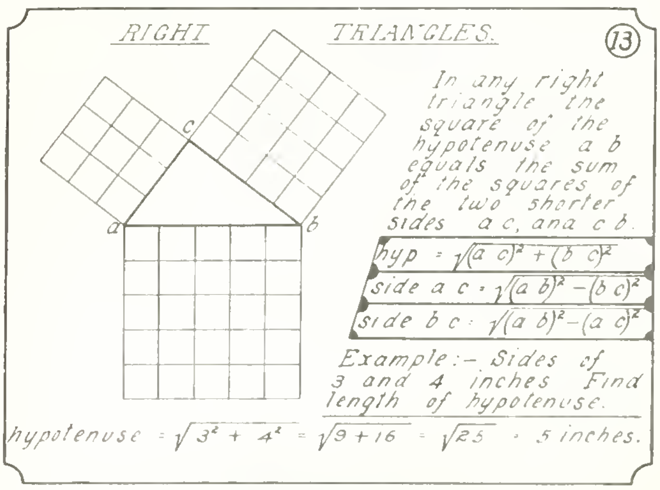


ARITHMETIC CHART 12.

A vertical line is one having the direction of a plumb line, or is at right angles to the horizontal. Intersecting lines are those that cross each other.



ARITHMETIC CHART 11.



ARITHMETIC CHART 13.

An angle is the opening between two lines that meet at the vertex of the angle. (See Chart 10).

When expressing an angle by the use of figures or letters, the vertex is always denoted by the middle letter, as (a.o.b.), (o) being the vertex of the angle.

A right angle is one of 90°.

An acute angle is one of less amount.

An obtuse angle is one exceeding 90°.

When one line meets another and forms two adjacent angles, these two angles will equal two right angles.

When one line crosses another and forms four adjacent angles, the sum of the four will equal four right angles.

Plane Figures.

A plane figure is any part of a plane surface bounded by straight or curved lines.

A polygon is a plane figure inclosed by straight lines.

The perimeter is the sum of the bounding lines.

A regular polygon is one in which all the angles are equal, and all the sides are of equal length. Several regular polygons are shown in Chart 12.

The Triangle.

Triangles are of four kinds; isosceles, scalene, right angled and oblique angled.

An isosceles triangle is one with two of its sides equal, and when three of its sides are equal, it is called an equilateral triangle.

A scalene triangle is one in which no two sides are of equal length. This also applies to an oblique triangle.

When one of the angles is a right

angled triangle the triangle is called a right triangle, and the side opposite the right angle is called the hypotenuse.

The altitude of a triangle is the perpendicular height from the vertex to the base or base extended. (See Chart 11).

The sum of the three angles of any triangle equals two right angles.

In any right angle triangle the square of the hpyotenuse equals the sum of the squares of the other two sides. (Chart 13).

Example: What is the length of diagonal of a square with 3 inch sides?

By formula, Chart 13, the diagonal or

hypotenuse $= \sqrt{(ab)^2 + (bc)^2} = \sqrt{3^2 + 3^2} = \sqrt{9 + 9} = \sqrt{18} = 4.242$ inches.

A triangle, whose sides are proportionally the same as those shown on Chart 13, will form a right triangle, thus, sides of 3, 4 and 5 or 9, 12 and 15 etc., will form similar triangles, although varying in size.

To prove this, draw the straight line (ab), 15 inches long. From (a), as a centre, with radius of 9 inches describe an arc, and from (b), with radius of 12 inches, describe an arc intersecting the other arc at (c); then (acb) will be a right angle or 90°.

By figures, we have, from Chart 13,

hypotenuse $= \sqrt{(ac)^2 + (bc)^2} = \sqrt{9^2 + 12^2} = \sqrt{81 + 144} = \sqrt{225} =$ 15 inches.

Again side ac $= \sqrt{15^2 - 12^2} = \sqrt{225 - 144} = \sqrt{81} = 9$ inches, or side bc $= \sqrt{15^2 - 9^2} = \sqrt{225 - 81} = \sqrt{144} = 12$ inches.

FACTORY ACT AMENDMENTS.

INSPECTION of all boilers in use in Ontario, excepting those in private residences, is to be made compulsory in an amendment to the Factory Act inintroduced into the Legislature by Hon. James S. Duff last week. The present law provides for the inspection of all boilers used in factories, shops and office buildings at least once a year, but there appears to have been no inspection of boilers in hotels, schools, theatres and other public buildings. In the bill now presented, these boilers are put in the same position as the others.

The proposition for general inspection was first linked with the suggestion that the boilers be inspected by the province, but as half the boilers in the province are under private inspection, the boiler insurance companies would practically be forced out of business.

Several other amendments are to be made to the Act regarding the working hours of children. In canning factories the working hours for children are to be reduced from ten to eight, and the employment of boys under eighteen years of age on elevators is prohibited.

The Stationary Engineers Act is to be amended, bringing all men in charge of hoisting engines under the law, so that in future they will have to secure certificates as other stationary engineers have to do.

RESTORING PUBLIC CONFIDENCE.

MR. C. C. BALLANTYNE, vice-president of the Sherwin-Williams Paint Co., discussing the trade outlook a few days ago, said: "Conditions throughout Canada are gradually improving, and with a good crop I am of opinion that industrial conditions will soon be normal. I do not look for a boom, but an early continuance of good business on a sound basis.

"The paint business is a first-class barometer, inasmuch as paint is a luxury, and is not used unless other and more urgent needs are well looked after. The sales of this company and its subsidiaries for the month of March show a substantial increase over the same month in 1912, and on this account I feel that the worst has been passed and that a steady improvement is at work."

Asked regarding western business, Mr. Ballantyne stated that orders from there were in bigger volume than last year, and that sales showed a fair increase. This depression, he said, had taught the West a good lesson, and much of the old gambling spirit which had developed has now disappeared. Westerners realized this, and business from now on will be steadier and sounder. Retailers of the West have bought little of late, and will soon have to come into the market, which will naturally tend to stimulate the manufacturing centres. The blue ruin talk regarding the West, he went on to say, was without foundation, and conditions there also are perfectly sound.

Believing that lack of confidence is delaying greatly the returning of prosperity, the Sherwin-Williams Company has started "the new prosperity campaign," a movement designed to stimulate the company's own business, and Mr. Ballantyne said that if other large manufacturers would adopt the same method and talk confidence, conditions would quickly right themselves. The farmers of the country were never more prosperous, and retailers of the smaller centres are naturally in good condition.

"All that is needed," he went on to say, "is a little encouragement from the big concerns to renew the confidence of the general public, which is now lacking."

INTERNATIONAL ENGINEERING WORKS, LTD., REPORT.

IT has not been altogether easy sledding for the International Engineering Works, Ltd., during its first year of operation. This company, it will be recollected, is a reorganization of the Robb Engineering Co., which went into liquidation some twenty odd months ago. Reorganization was completed by the Corporation Agencies of Montreal about the 1st of March, 1913, and the financial statement recently presented to shareholders represents operations for the ten months ending December 31st, 1913.

The total volume of sales during 1913 amounted to $830,000; but after charging selling and managing expenses, the profits on the year's operations were only $12,590. The smallness of the profits was due largely to unremunerative contracts taken over from the old company, and to the general slackening in business during the last two months of the year. During November and December, and also during the first two months of the present year, business fell off very considerably, and earnings were not nearly up to expectations. The tide has now apparently turned, and it is reported that business is very substantially increasing. Orders on hand at boh factories at present exceed $100,000, and prospects are for a fairly profitable year. Various sweeping reductions have been made in management, selling and overhead factory expenses, and this will result in a larger profit, even if the present flow of orders be not maintained.

The balance sheet of the company shows fixed assets made up of real estate, buildings, plants, equipment, as appraised by the Canadian Appraisal Co., at the depreciated values of July 1st, 1912, together with costs of subsequent additions, of $802,000. The surplus of current assets over current liabilities amounts to $339,000. Profits from operations, as stated above, is before payment of bond interest.

The old board of directors was reelected with one exception. It consists of Messrs. C. H. Cahan, K.C., president; H. A. Lovett, K.C., vice-president; C. H. Cahan, jun.; D. W. Robb, G. W. Cole and R. Binkley. Mr. G. W. Cole, the present acting general manager of the company, was elected to the board of directors, in the place of Mr. R. Garret, the former manager, who has resigned.

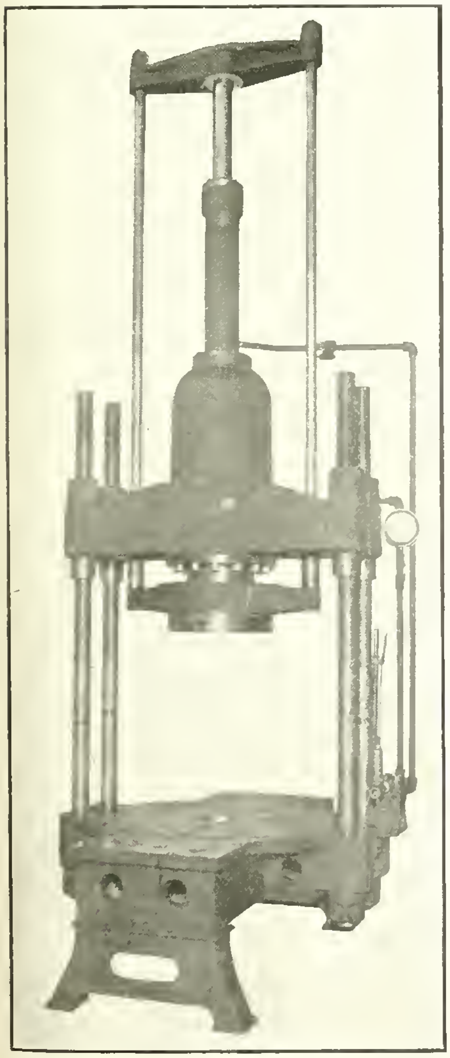
DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

HYDRAULIC STRUCTURAL STEEL AND BAR STRAIGHTENING PRESS.

OUR illustration shows a new design of hydraulic press recently built by the Hydraulic Press Manufacturing Co., Mount Gilead, Ohio. Although orginally intended for straightening structural steel, bars and shafts, it can be used for a wide range of work in machine shop service, such as bending, forcing, forming, broaching, etc.

The daylight or stock space of this press has a variation of 28 inches—20 inches minimum and 48 inches maximum. The strain rods are threaded on their upper ends to one-third of their length, and are provided with nuts adjusted to both upper and lower sides of the cylinder bearings. When it is wanted to increase the daylight space, a block or some other suitable material is placed between the ram and pressure bed. The upper nuts are then set, and the pressure applied. This action raises the cylinder to these nuts. When the work is of such character that it requires a smaller daylight or working space, the block is still kept between the ram and pressure bed, the lower nuts being adjusted to the point desired, while the pressure is still applied. The pressure is then released, thereby taking the strain off the upper nuts, and lowering the cylinder accordingly. The upper nuts are then adjusted to place. To permit the raising and lowering of the cylinder the pipe connections are provided with swing joints.



HYDRAULIC STRUCTURAL STEEL AND BAR STRAIGHTENING PRESS.

Tee slots are provided in both the ram head and press bed for attaching bending blocks, forms or dies. The press bed permits maximum centres of 72 inches for bending. The long press bed also permits the use of an overhead crane in placing structural steel and other heavy material on it. The press bed is constructed with a hole in its centre, permitting the press to be used for broaching work and for forcing wheels on and off shafts, axles, etc. The pressure capacity of this press is 250 tons. The diameter of the ram head is 20 inches, and the run of ram is also 20 inches. The length of the press bed over all is 72 inches, while the width of working space is 26 inches. Steel is used throughout in the construction.

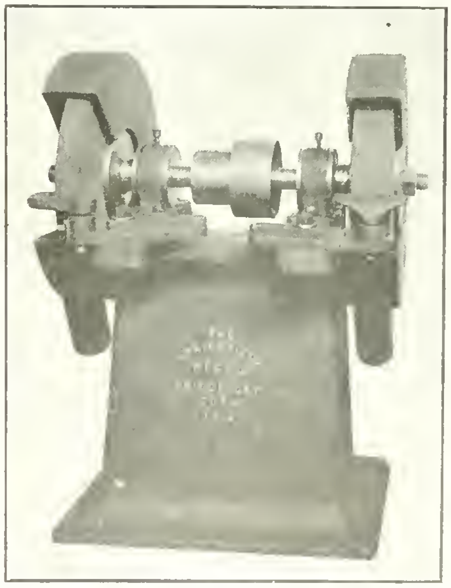
The four-way poppet operating valve used in operating this press applies the pressure to either the main pressure ram or the return ram working in the pullback cylinder, and at the same time permits the water or oil used in operating the press to return to the pump reservoir from the cylinder on which the pressure is released. This valve is operated by a single lever with three positions:—1st—Pressure on main pressure ram and release on return ram. 2nd—Pressure on retur nram and release on main ram. 3d—Neutral position, holding pressure with the rams at any point in their travel in a stationary position. A five-way high and low pressure, double-acting, balanced poppet operating valve is furnished when desired.

Smile at the world and you get a smile back; give it a scowl and it will shake its fist under your nose; treat it with indifference or neglect, and it will forget that you live.

BALL BEARING DRY GRINDER.

THIS machine is a product of the Springfield Mfg. Co., of Bridgeport, Conn., and is made to meet the most severe duties that modern grinders are subjected to under continuous service with the least power consumption. The ball bearings used are of high class annular type and are amply large to carry many times the load that these bearings would ordinarily be called upon to sustain.

The outer bearing case, or box, is specially designed for grinder service, bing made with two felt packing rings on each side of the bearing. In addition to this end shells fit closely to the shaft, making it practically impossible for any direct or dust to reach the ball bearings proper. The bearings are filled with high grade lubricant sufficient to run for a considerable length of time. The makers have operated these machines under a test of three months' continuous run which, it is claimed produced no appreciable signs of wear on the bearings. When desired, the machines are furnished with a special type of hood for encasing the wheels. These are made to enclose the wheel completely with the exception of the space necessary for grinding purposes and, for changing the wheels the end cover is made easily removable as shown. The hoods are made with or without exhaust connections.



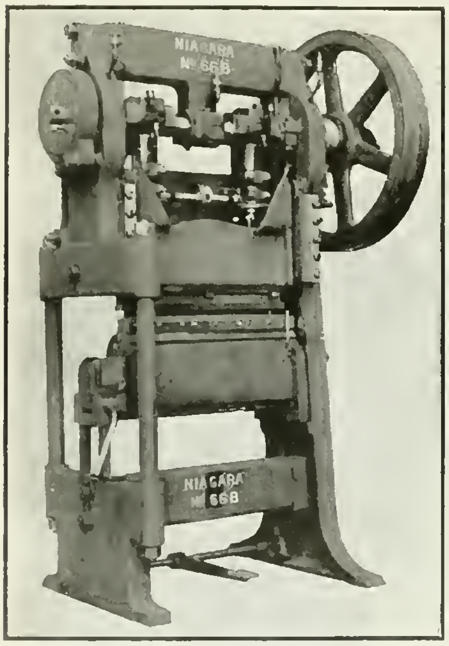
BALL BEARING DRY GRINDER

The strong point of these grinders is of course, easy running, and it is claimed that the power saved will, in a very short time, pay for the investment.

NIAGARA SIDE SEAMING MACHINE.

FIG. 1 shows a side seaming machine which constitutes a recent product of the Niagara Machine & Tool Works, Buffalo, N.Y. This machine is intended for use in forming the longitudinal seam in sheet metal used in the manufacture of oil and asphalt barrels, ash cans and similar products.

Fig. 2 shows in diagrammatical form the ends of two pieces of sheet metal before and after making the lock seam. This seam is formed by two consecutive strokes of the machine. Aside from forming the body, no preliminary work is required. The motion of the machine is controlled by a positive clutch, and the horn has a swinging support on its outer end to provide for entering and removing the work. A safety lock is



NIAGARA SIDE-SEAMING PRESS.

provided which makes it impossible to trip the clutch before the horn support is in the proper position. This machine has a capacity for work ranging from 9 to 24 inches in diameter, and up to 36 inches in length. Sheet metal up to No. 24 gauge can be handled.

CAR COMPANIES' OUTLOOK.

THE Canadian Car & Foundry Co., has orders on its books for passenger cars sufficient to keep its passenger department operating at full capacity for the next seven or eight months. Car parts, wheels, and accessories used in repairing rolling stock are also in demand; and the shops of manufacturers of this class of goods have been fairly well occupied and will be busy in the future.

Orders for freight cars up to date are disappointing. The Canadian Car and Foundry Co. has sufficient orders for them on hand to keep its plants in operation at present low capacity for the next two months, before the expiration of which period it is more than likely

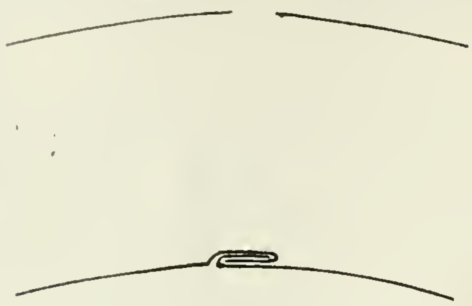


FIG. 2. BEFORE AND AFTER FORMING LOCK SEAM.

that large orders will be received from the Canadian railways. This department is only operating at about fifty per cent. of its total capacity, and if the plant were pushed, orders on hand could be turned out in about thirty-five days; but pending receipt of further orders, the plant will be kept operating at present rate for at least the next two months.

The Grand Trunk Pacific, the C.N.R., and the Intercolonial Railway, it is well known, are in pressing need of rolling stock. The financing of the Canadian Northern will mean that there will be money available for new rolling stock, and that road, it is estimated by car supply men will need 250 passenger cars and 10,000 freight cars, and it is reasonable to expect that Canadian car makers will get their share of this. As freight cars cost from $1,100 to $1,500, passenger cars from $16,000 to $20,000, dining and sleeping cars about $28,000, even a small portion of the C.N.R. order would mean a great deal to Canadian car manufacturers.

Grand Trunk equipment orders have been held up, owing to partisan squabbling at Ottawa, but the new equipment financing is said to be once more well under way and it cannot be long before the National Transcontinental will be ordering its rolling stock, which will mean an expenditure of more than $10,000,000.

The Intercolonial is also said to be in need of a great deal of new rolling stock.

All these are real urgent requirements of Canadian railways, and postponement cannot be made for very much longer of orders for at least a part of this equipment, even a small part of which would successfully tide the car manufacturers over their worst period of dullness. Although the Canadian Car & Foundry Co. can if necessary wait two months and keep its plant operating for that time without any more orders, it is unlikely that it will have to do this, as the railways will undoubtedly have to tap the market at an earlier date.

The Canadian Pacific Railway, owing to its heavy purchase of cars last year from car builders in the United States as well as in Canada, will not be much in the market for new rolling stock this year, but the other railways will more than make up for this deficiency.

CANADIAN PIG IRON IN UNITED STATES.

A RECENT issue of the Iron Age makes the following suggestive comments relative to the export and disposal of Canadian made pig iron in the United States:

The new cross currents which the reductions in iron and steel tariffs will introduce in American foreign trade statistics are illustrated by the impending increase in pig iron imports from Canada. Should the shipments of Dominion Iron & Steel Company pig iron to the United States this year be only the 20,000 tons already sold to New England and Delaware River foundries, the 1914 total will be several times the average import from Canada in recent years. At 1976 tons in 1908, with slight increases in the interim, the total being 4609 tons in 1913, Canadian pig iron shipments have been generally reckoned as principally electrolytic ferrosilicon produced at Welland. The shipment of Nova Scotia pig iron into the United States is especially noteworthy in view of the heavy exports of pig iron from this side of the line into Canada, chiefly to Ontario, these reaching 193,396 tons in 1913 and being at a maximum of 208,581 tons in 1912, as against only 44,758 tons in 1909. The large figures for 1912 and 1913 tell of the boom across the border that has now given way to marked recession.

That foundry pig iron shipments should be going in both directions between Canada and the United States, as at present, is not only a result of the new tariff, but a phenomenon of the far-extended territorial contracts of the two countries. Even with Canada's duty of $2.50 on pig iron, Buffalo district furnaces command a trade of 200,000 tons there as against the Nova Scotia furnaces now invading our Eastern seaboard.

It should not be overlooked that the appearance of Dominion pig iron in our Eastern markets is really one of the signals of the distress under which Canadian industries are laboring lately, in common with our own. Normally the Dominion Iron & Steel Company's pig iron is all needed by its steel works and it is a most exceptional condition that prompts the marketing by the company of anything but semi-finished or finished steel.

INDUSTRIAL NOTABILITIES--No. 29

PAUL JUDSON MYLER was born at Pittsburgh, Pa., April 24, 1869, a son of Thomas T. (a dry goods merchant), and Caroline C. (Mackay), Myler. The paternal ancestors were of Irish, and the maternal of Scottish nationality. His education was obtained in the public schools of his native city, and culminated in his graduating from the Pittsburgh Central High School in 1884.

His first occupation thereafter was that of bookkeeper in a produce commission house, following which he entered the employ of the Westinghouse Air Brake Co. in 1886, as bill clerk.

In 1896 Mr. Myler moved to Canada as secretary of the Canadian Westinghouse Air Brake Co., and in 1903 he was made vice-president of the Canadian Westinghouse Co., Ltd., which was formed to take charge of all the Westinghouse interests in Canada.

PAUL J. MYLER

Mr. Myler is president of the Hamilton, Waterloo & Guelph Railway Co. and a director in The Travellers Life Insurance Co. of Canada.

Among the clubs, he is chairman of the Board of Governors of the Hamilton Club, and a member of the following:—The St. James' Club of Montreal, the Duquesne Club of Pittsburgh, Pa., the Lawyers', Engineers' and the Transportation Clubs of New York City; the Thistle, the Hamilton Golf, the Royal Hamilton Yacht and the Hamilton Jockey Clubs of Hamilton.

He is also a member of various Railway and Technical Clubs and Associations in Canada and the United States.

Mr. Myler was married October 26th, 1898, at Hamilton, to Lily Maude Lottridge, a daughter of Mr. J. M. Lottridge.

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Vol. XI. APRIL 9, 1914 No. 15

PRINCIPAL CONTENTS.

SAFETY FOR CITIZENS.

FROM the State of Washington, we hear of the newest and withal one of the sanest campaigns for the protection of citizens from injury due to carelessness of their own or of others. At the request of Governor Lister, the Industrial Insurance Commission and the State Labor Department have conferred, with the result that safety committees of workmen are being organized in all parts of the State. These committees will each consist of three men whose duty it will be to receive reports from other workers as to dangerous conditions of surroundings or machines, and to carelessness on the part of other workmen as well as to do safety work on their own initiative.

Here we see a safety campaign instituted, not by manufacturers and contractors driven to it by legislation for workmen's compensation for injuries, but by the workers themselves, backed up by the highest Federal authority. That these committees will be earnest, enthusiastic and thorough, if unhampered in their work, goes without saying, and we can rest assured that the work will be well done, yet without the cost of the installing of more or less superfluous safety appliances as is often the case.

Statistics of the Industrial Insurance Commission point out that less than three per cent. of accidents are due to unsafe machinery. With the responsibility for permitting carelessness, the great cause of accidents, placed upon the shoulders of the workmen themselves, we expect to see them much better looked after by each other than was possible when this responsibility rested entirely with the employers.

THE COLLEGE ENGINEER.

THE time is almost with us, when the universities will add their annual contribution of young manhood to the commercial and industrial world. This event seems to be no great source of pleasant anticipation to a great many of our managers and superintendents who inevitably become acquainted with these embryo engineers sooner or later.

"You say you want a position. What kind of a position?" "A position as assistant superintendent or foreman, I should say, sir." "Yes, what experience have you had along that line?" "Very little, sir. I am a university graduate with honors." "Can you tell an industrious and loyal man from a natural born loafer, and can you keep men constantly up to their work and hold their good will at the same time?" "Probably a position as inspector would suit me better." "Can you line up an engine or could you pick out the loose rivets in a boiler or a girder?" "N—no, but I could soon learn that. I certainly could fill the position of a chief draughtsman." "Do you think you could write up a specification that would give us all the rope possible and still look good to the other fellow?"

If the prospective employer be himself a graduate of the school of hard knocks, or if he be an energetic disciple of the doctrines of R. T. Crane and others, we can look for little consideration on his part for the ambitious applicant. The conversation usually ends with a more favorable aspirant being offered a trial as a junior draughtsman or as an apprentice in the machine shop, the latter generally being declined with more or less affronted dignity.

The greater proportion of our employers are much more kindly, even though they sternly follow the path of business expediency. The men whose success has been and working them advisedly for the best that is in them. and working them advisedly for the best that is in them. can often see in this raw material some finished essential element to a successful organization.

The university man is often the victim of parents who are imbued with the idea that, by some mystic means, a great centre of learning can so mold their son as to pro-

duce, at once, a master mechanical and organizing mind. He is sometimes the offspring of wealthy parents who are moved almost solely by a romantic interest in the mysterious and potent word "engineer."

Under our present system of educational segregation, the student's first experiences upon entering the world of work and achievement is fraught with many disappointments. He has attained "something," and even though he can find no direct use for it, he cannot help but feel that it places him in a class above those who have it not. His apparent assumption is often the outcome of a personal sense of ignorance of things that are common knowledge to those whom he has been wont or taught to consider his natural subordinates. "Who's the new gaffer, John?" "Oh, he's one o' those stuck-up college guys what don't know nothin'."

The difficulties of the thorough mechanic who succeeds in getting for himself a college training are very little less at the beginning, for he finds hundreds of technical men working for a much smaller remuneration than he received as a daily wage. He finds that executive and organizing ability or the power of focusing different minds harmoniously to a common achievement is more in demand than great scholarly accomplishments.

The employer has found in the product of our educational institutions, a very incomplete and unbalanced cog to apply to the wheels of industry. He finds it necessary to invest in these men a great deal of tedious and expensive training at the end of which his engineer is a very uncertain quantity when offered inducements by others.

At the present time, there is little harmony and cooperation between our colleges of learning and our centres of industry, but we fondly look forward to such a coordination of these necessarily allied interests that the youth of suitable natural endowments can, without the assistance of his father's purse or social position, and with his own energy and personal worth, obtain a training that will enable him to take the reins of production without humiliation to himself, the envious dislike of those under him or the bringing of disappointment and chagrin to his superiors.

TARIFF REVISION.

As we go to press, the details of the Budget speech of the Hon. W. T. White, Minister of Finance of the Dominion Government, come to hand.

Limiting ourselves on this occasion to a few observations only, there is evidence that in a general way manufacturers have been given the bulk of the favors, and as a consequence a moderate revision upward of the tariff is the real and ultimate effect. It is unnecessary perhaps for us to say that a more or less widespread dissatisfaction will be voiced by the agricultural section of our population, and as a result a decided lessening of that community of interest that should exist between East and West.

As in most countries, there exist two sharply defined opposing classes, separate from polities, except in so far as that feature can be made a tool in their hands; so in Canada also there is to be found a like condition prevailing. We have, largely due to our territorial expanse and natural development, the manufacturer on the one hand and the farmer on the other, each ostensibly working for the welfare and development of our Dominion, but actually, on every occasion and by every known means, and the latter perhaps not always strictly within the moral law or that of common decency, working for himself. Our manhood and national progress is being sapped by the canker of individual selfishness and personal gain, so much so that no other consideration, but that of getting the better of the opposing interest, is ever apparent.

We are a young country, but growing and developing rapidly. In the upbuilding of our industries and manufactures we of necessity had and have to protect ourselves, but it is surely no sign of growing strength in our manhood and skill, if the props, one by one, be not removed as time goes on. Our farmers in the matter of selfishness and quest of personal gain are not a whit behind our manufacturers, yet it cannot be gainsaid that much as the prosperity of our country is dependent upon the results of their labors, their influence is not as potent when it comes to swaying a government to make concessions for them.

If the welfare of this Dominion and the adjustment of matters on which our East and West are so much at odds were handled by representative men on each side, periodically and thoughtfully, and if the detestable political feature were eliminated, there would be less unrest in every sphere of our national life, less crime, less poverty, and a higher staging of our country in the estimation of other nations.

SOME PHASES OF SCIENTIFIC MANAGEMENT.

The study of scientific management was begun by Mr. W. F. Taylor about thirty years ago and the results of his researches were presented to the public in June, 1903. In a very few years he had a large number of followers, his theories being enthusiastically received by many, and his writings directing the thoughts of some deep-thinking men along these and similar lines. The attitude of the operatives in many factories at that time was giving their management no small concern, so that many employers were more or less ready to adopt any system of government for their plants that would seem to be a solution of the great and growing problem of labor unrest. "Scientific Management" deals primarily with the workman, and, if necessary, subverts the rest of the organization to his necessities.

The principle and most successful modification is the "Emerson" system which differs from that of Mr. Taylor in that the systems in use are simply supplemented by the addition of enough specially trained men to carry out the calculations and to do the work peculiar to the new system. This arrangement has, so far, been the most used, and has been an unqualified success in many institutions, particularly in the United States; and its failures, in most cases, have been attributable to easily discernible causes. Strange to say, its most important feature, the accurate standardization of work by the study of work elements is the most neglected part of the system. This science is more or less mystifying to financial and business men, and they have been loath to delegate it to technically and mechanically trained men. The work of its inauguration has been largely intrusted to office clerks and to contract estimators, with no consideration of the natural antipathy of the workmen towards these men.

The operative must be taught how to use most economically the machine under his charge. He must be made to overcome the greatest obstacle to the plan on his part, the habit of doing things wrongly and in the wrong order. This necessitates an efficient demonstrator.

It has been found that the general inaccuracy of work has in some cases, been a serious obstacle to the successful adoption of Scientific Management. The proper calculation of the extra work caused by ill-fitting parts is not only the most difficult for the specialist, but the work itself possesses the smallest element of profit. One of the first essentials to the success of the new system, therefore, is the perfection of mechanical operations and processes in vogue with the old system.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal	Toronto.
Grey Forge, Pittsburg.	.....	$13 90
Lake Superior, charcoal, Chicago	.....	16 00
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1........	19 00	18 35
Victoria, No. 2X.......	18 75	18 10
Victoria No. 2 Plain...	18 50	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh.........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal.	2.05
Steel bars, f.o.b., Montreal.......	2.05
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh.....	1.20
Steel hoops, Pittsburgh..........	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, 5/8 diam., 100 lbs.		2 85

BOILER PLATES.

	Montreal.	Toronto.
Plates, 1/2 in. 100 lbs.	$2 20	$2 20
Heads, per 100 lbs.......	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate Washers	45
Machine bolts, 3/8 and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb off
Nuts, Hexagon, all sizes..	4½ per lb off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright ......85, 10, 7½, 10, 10 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off	
Wood screws, flathead, bronze ....70, 10, 7½, 10 p.c. off	

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in...	75%
Finished Nuts over 1 in....	72%
Semi-Fin. Nuts up to 1 in..	72%
Semi-Fin. Nuts over 1 in...	72%
Studs....................	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings..	9 00	9 00
No. 1 wrought iron.....	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	12 00	12.00
New brass clippings....	8 50	8 75
No. 1 brass turnings....	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
1/8 in	$ .05½	1/8 in	$ .12	½	$. 32
¼ in	.06	¼ in	.07½	¾	.35
3/8 in	.06	3/8 in	.07½	1	.37
½ in	.08½	½ in	.11	1¼	.52½
¾ in	.11½	¾ in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼ in	.23½	1½ in	.30	2½	1.37
1½ in	.27½	1½ in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½ in	.58½	2½ in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½ in	.92	3½ in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½ in	1.27	4½ in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	.....	...	.....
10 in	3.50	....	.....	.....	.....
10 in	4.12	....	.....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, 3/8 in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in....	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in. ..	....	....	67½	56½
X Strong P. E.				
¼, 3/8 in	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto
Lake copper, carload....	$15 75	$15 75
Electrolytic copper	15 50	15 25
Casting copper	15 00	15 00
Spelter	5 25	5 25
Tin	40 00	41 00
Lead	4 85	5 30
Antimony	8 50	8 50
Aluminum	21 00	19 00

SHEETS.

	Montreal.	Toronto.
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4.30	4.10
Queen's Head, 28 B.W.G.	4.40	4.20
Fleur-de-Lis, B.W.G.	4.20	4.20
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.20	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal	0.22
Pure turpentine	0.69
Linseed oil, raw	0.60
Linseed oil, boiled	0.63
Plaster of Paris, per bbl	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

THE BUSINESS OUTLOOK.

As spring approaches there is an evident tendency towards greater confidence; but facts, such as generally guide business men, are of a character that compel caution. March bank clearings, for instance, indicate beyond doubt that trade decline is still in progress. Railroad earnings are also equally definite on that point. Foreign trade decline has not yet been arrested, according to press reports from Ottawa, although export trade will be affected somewhat by the decline in food prices in Britain.

The Political Factor.

There is also for the time being a very depressing factor in the political situation. Whatever the Finance Minister announces will be welcomed, as it will remove from the outlook an element of uncertainty. If no aid is given to steel manufacturers they will accommodate themselves to conditions, and if their wishes are met, they will do likewise, but with more heart. They will also be cheered by the prospect of a settlement of the railway outlook. Premier Borden has intimated that the railway situation will be met, which is cheerful news. What is next needed is settled conditions.

Our Neighbors.

Those who have hopes of sharing prosperity with the United States are apparently doomed to some disappointment. The bankers there have made up their minds that the important questions now confronting that country must be settled before business can attain to anything like activity. The railroad question there is just as acute as that of Canada, and business generally appears to have settled down to quiescence until it is settled. There are indications that some decision may be reached by the beginning of May.

As in the United States, so in Canada, there is some hope in the fact that the common people are beginning to understand how closely business conditions are associated with the welfare of the leading enterprises of a nation, among the greatest of which are the railways.

Money.

Advices from London indicate that borrowing there during the first three months of the year is on a scale that has not been reached since 1910, and the record of that year has approximately been reached. Nevertheless there appears to be still considerable money available there for investment, as indicated by the satisfactory reception given to recent Canadian issues. This is a good sign.

A New York banker says that public sentiment once energized in a given direction gathers force as it proceeds, and with regard to certain public questions in Canada, sentiment is being energized, and will, no doubt, have its effect. With big political business questions uppermost in the public mind no great change can be expected, but meanwhile factories and business houses are being put in order, and when once business is energized, we believe it will gather some force, even as early as the next few months.

Montreal, Que., April 6, 1914.—Readers should note that the Montreal prices for English and Scotch pig iron, given this week on the opposite page, are prices "on dock, Montreal," at the opening of navigation. For loading into cars the charge is 40 cents per ton extra. These quotations are the lowest obtainable for car-load lots, and some dealers are asking even higher prices. For instance, the price of Middlesboro, No. 3, varies from $17.75 to $18.25, and intending buyers should bear this fact in mind. Very few inquiries are being received as yet for first half delivery, and it is a long time since the pig iron market was as dull as it has been during the past few weeks. The demand for copper, tin, lead, etc., is also very dull.

The directors of the Montreal Arena have now definitely decided to install an artificial ice plant at their skating rink, and it is to be ready for operation next Fall. Tenders for the refrigerating machinery and equipment will be invited just as soon as the plans have been got out; but it is too early yet to say whether the machinery will be steam or motor-driven. The plant will be thoroughly modern, and will probably necessitate an outlay of from $60,000 to $80,000.

The Montreal Board of Trade are still urging the Government at Ottawa to do something to improve the pilotage conditions on the St. Lawrence. They have recently renewed their petition to the Minister of Marine and Fisheries asking for special legislation, which will provide for the abolition of the Quebec Corporation of Pilots and put pilots under the control of the Minister of Marine and Fisheries, so that conditions may in future be the same below Quebec as above it. The appointment is urged of a superintendent of seagoing experience, who is neither a pilot nor an ex-pilot, to have full charge of the district above and below Quebec. It is understood that the Hon. J. D. Hazen intends to put through special legislation in time to be effective for the approaching season of navigation.

The snow is rapidly disappearing, and in a few weeks from now a great increase in activity in the building trade is looked for. A large number of residences will be erected, but only two large office buildings are at present spoken of. One of these is the rebuilding of the Bank of Toronto at the corner of St. James and McGill Streets, and the other is the Marcial Trust Building on the site of the old Herald Building on Victoria Square. Large office buildings have been put up in such numbers during the last year or two that the demand for space has slackened off considerably; in fact, tenants are able to pick and choose their accommodation just now pretty much as they like—a very different state of affairs to that existing three or four years ago.

Toronto, Ont., April 7, 1914.—Any marked improvement in trade generally is still a negligible quantity. It was to have been expected that with the advancement of the season business conditions would have assumed a brighter aspect. This expectation will, however, be delayed in its fulfilment until a greater degree of confidence is exhibited by manufacturers and financial concerns. The budget announcement, which has been anticipated with interest, indicates a desire on the part of the Dominion Government to assist the steel industry. The tariff has been increased in a few cases, the most important being the addition of a duty on wire rods, which were previously on the free list, but are now subject to a tariff of $2.25 to $3.50 per ton. Seamless steel tubing and rolled steel angles, shapes, etc., are included in the list of articles subject to an increase of duty, although, in the latter case, the increase is insignificant. The publication of the tariff should have the effect of clearing the air and result in a more settled condition in business circles generally.

Dull, or its equivalent, is the only word that can be used in expressing an opinion as to the present condition of the steel market. As anticipated in our report of last week, prices for this quarter have not advanced over those of the preceding period, and the volume of business is still light. The mills are still endeavoring to keep prices up, but it remains to be seen how far they will be successful in doing this, in view of the light specifications being sent out by consumers. There is a probability that a slight reduction will be made in some lines. We understand that the Canadian Vickers Company have sent out an inquiry for 3,000 to 4,000 tons of plates and shapes for the icebreaker which they will build.

Little can be said regarding the state of the market for pig iron; prices are stationary, and the tonnage is light. It is probable that if any change in prices takes place it will be in an upward direction; at present, however, business is very quiet.

Dealers in machine tools report business as being quiet, with few specifications on hand. The activity noticeable early in March has not been maintained. During that period a number of inquiries were sent out, but buyers appear to be holding back until trade generally shows more definite signs of improvement. The locomotive and car building plants are quiet on account of the railroads holding back orders for equipment. The situation in this respect may be relieved as soon as the Dominion Government have announced their decision regarding the negotiations pending.

The general situation in the metal market is unchanged, business being inclined to be dull, although orders are now being received for somewhat larger quantities than for some time past. Copper is stronger, but other metals show the same weakness as exhibited during the past few weeks.

Winnipeg, April 4, 1914.—Business in machine tools shows considerable improvement on last week. Several big orders have been filled, and a large volume of inquiries have been received, mainly from small machine shops and garages, their requirements averaging around $1,000 to $2,000. If things materialize as some of the brokers here expect them to do, some good business should be written up during the coming week. The supply business has been unusually good, the demand being mainly for twist drills, grinding wheels, transmission equipment, etc.

While the railways on the whole in the West have expressed their determination not to buy machine tool equipment just now, the C. P. R. is this week in the market for two separate lots for coal handling plants at Fort William and Winnipeg. Their specifications are for an 11-inch lathe, a 26 x 48 gap lathe, a 36-inch drill, a 24-inch shaper, one power hack saw, a grindstone and frame, pressure blower, stationary forge, an emery grinder, one 10-h.p. electric motor and considerable transmission equipment. Most of the machine tool brokers in the West are figuring on this order.

The City of Calgary, who were in the market for a considerable number of iron and wood-working tools, for some reason or other cut their order in two, which was distributed over a large number of brokers. The Alberta Rolling Mills, who have operated a rolling mill in Medicine Hat for two years, recently added a bolt and nut department to their business. The order for the machinery equipment has been placed with the Stuart Machinery Co., Winnipeg, and amounts to over $10,000. This firm will shortly be in a position to supply demands in Western Canada for nuts and bolts. J. L. Pollock is the president.

It was stated recently that Henry Birks and Son, manufacturing jewelers, who are amalgamating with Porte & Markle, would be buying machinery for the enlarged plant. It appears, however, that for some time they will make the largest possible use of the equipment formerly used in the Porte & Markle plant, which is being transferred to the new premises.

A new machine shop has opened up at Moosomin, Sask., for general repair work. The machine tool equipment required was supplied by the A. R. Williams Machinery Co., Winnipeg, and included lathes, drill, shaper, and other smaller tools.

The Hudson's Bay Co., contemplate building a sawmill at Fort McMurray, to enable them to fit out a steamboat, the framework for which was recently erected by the Doty Engine Works, Ltd., Winnipeg, and is being shipped by rail to the above point.

The building permits granted in Winnipeg for the coming summer are away ahead of what they were last year, which indicates that demands for structural steel, builders' hardware, etc., should be heavy, a contingency altogether unexpected.

It is understood that the Ford Motor Co. of Walkerville and Detroit, are contemplating erecting a branch plant in Winnipeg to take care of their business in Western Canada.

St. John, N.B., April 4, 1914.—The increasing importance of St. John in the industrial world is indicated each week by the several letters from firms in Upper Canada, England, and the United States, written to the Board of Trade, asking information regarding possibilities, facilities of shipping, trade regulations, etc. The Board of Trade have been conducting an active campaign for the promotion of new industries, and thus far have been very successful. H. T. Hoag, former secretary, who was brought here from Poughkeepsie, N.Y., at a $4,000 salary, has resigned, and R. E. Armstrong, a former St. John man, has been appointed to keep up the good work.

A new company called the St. John Knitting Co. has been organized, to take over the plant of the Parks Knitting Co., operated under direction of the late W. J. Parks in St. John. It is the intention of the company, which is headed by Walter E. Foster, managing director of Vassie & Co., to enlarge the plant and install more modern machinery, and to possibly engage in the manufacture of other lines, such as sweaters and fancy knitted goods. The company has secured the lease of the building in which the factory is conducted for another term.

E. G. M. Cape, head of the E. G. M. Cape Construction Co., while in St. John this week said that the expectation was that the building of the Atlantic Sugar Refineries, Ltd., would be completed by May. "The steel work was finished long ago," he said. "The placing of the machinery is, of course, a separate contract and may take some time, but the expectation is that the refinery will be in operation this summer."

A manufacturer from Upper Canada has been in Gibson, N.B., recently, looking over the ground with the idea of the establishment of a plant for the manufacture of barrels and staves.

ASSOCIATION AND PERSONAL

A Weekly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Machinery Circles

Personal

J. B. Woodyatt has joined the staff of the Southern Canada Power Company of Montreal.

G. Herrick Duggan, general manager of the Dominion Bridge Co., Ltd., is on a visit to Vancouver, B.C.

H. S. Holt, president of the Royal Bank of Canada, who is at present in Egypt, is expected in London, England in a few days.

D. W. Houston has been appointed acting superintendent of the Regina street railway system in place of Mr. H. Doughty, who has resigned.

H. E. Sherk, president of the Canadian Hart Wheels, Ltd., Hamilton, sailed from New York, recently, to spend six months in Germany and England.

Robt. A. Lyons, who, for over 15 years was chief engineer of the London Electric Co., has been appointed representative of the Garlock Packing Co., for Western Ontario.

C. A. Page, local purchasing agent of the Canadian Steel Foundries, Ltd., Welland plant, has resigned to accept the position of sales manager for the Canadian Hart Wheels, Ltd., Hamilton.

C. R. Walker, of the Cross Fertilizer Co., Sydney, N.B., has returned from a business trip through Ontario and expects to leave shortly for the West on a similar mission.

George E. Etlinger, of the firm of J. Birch & Co., London, Eng., export engineers, is making a tour through Canada. Mr. Etlinger will appoint agents to handle specialties on behalf of a number of British manufacturers.

David Webster, chief engineer of the Brantford, Ont., waterworks, was presented by the Board of Works Commissioners, with a gold watch suitably inscribed, in recognition of his 25 years of service with the city. He was previously for 12 years with a private company which owned the plant prior to civic ownership.

L. L. Anthes, manager of the Anthes Foundry, Ltd., Winnipeg, who has been at the Toronto plant for several months, is returning to Winnipeg. Business in the latter city is showing marked signs of improvement, especially lines of soil pipe. A staff of 45 men has been taken on, and this will be increased, it is expected shortly.

A. M. Lewis, president of the Canada Sewer Pipe & Clay Products, Ltd., Hamilton, Ont., L. P. Spittal, vice-president, and David New, expert in the company's employ, returned a few days ago from a trip of inspection through the brick plants of Ohio. The company will instal some of the latest machinery obtainable in the new plant to be opened in Hamilton.

R. Percy Sims, chief engineer and general manager in Canada for the Linde British Refrigeration Co., Ltd., is severing his connection with the company on May 1st, next, in order to devote his whole time to consulting work. his headquarters will be in Montreal. The Linde British Refrigeration Co. have consequently decided to close their Canadian office, as the profits of the branch have not been commensurate with those earned in other parts of the world. During the past three years the company have obtained a large number of orders from all over the Dominion; but, generally speaking, the returns obtained have been inadequate.

WHO'S WHO.

JOHN B. GOFF.
Sec.-Treas. Dart Union Co., Toronto.

Trade Gossip

The Polsons Iron Works, Ltd., launched on April 1, another of the six steel scows which they are building for the Quebec Harbor Commission.

Car Orders.—The Canadian Car and Foundry reports orders of 100 tank cars from the Standard Oil Co., of 50 freight cars from the C.P.R., and of 10 freight cars from the Montreal Harbor Commission.

Boiler Explosion.—One of the large boilers in the Bankhead plant of the Drummond colliery, Westville, N.S., operated by the Intercolonial Coal Co., exploded on April 2, and Daniel McMillan and J. Ryan were killed and five others injured.

The Siemens Co. of Canada, Ltd., Montreal, have received an order from the Union Carbide Co., of Welland, Ont., for some 46,000 volt single conductor cable. The cable will be paper insulated and lead covered, and will be made to withstand a test of 100,000 volts.

The General Supply Co., Winnipeg, who are Western distributers for the Beardmore Belting Co., have installed two 36-inch presses, and are now in a position to handle the belting business in proper manner. They have a large stock, and claim to have facilities unsurpassed between Toronto and Winnipeg.

The Siemens Co. of Canada, Ltd., Montreal, have received an order for over 700 water meters for the City of Edmonton. They will be of the vane type with frost protection. The order also comprises several compound meters with double ported valves and hydraulic balance, which is a special feature.

The Crystal Ice Makers, Ltd., are building a plant for manufacturing artificial ice for domestic purposes, in the Ashbridges Bay industrial district, Toronto. A fifty-ton "York" ice machine will be installed as an initial unit, followed by another of the same capacity later. The machine will be installed so that it can be operated by either a steam engine or electric motor. The raw water will be purified by electricity by means of an apparatus invented by Mr. George Bury, the president of the company. It is expected that the plant will be in operation by July 1. The company is capitalized at $300,000 and has an office at 2 Toronto street, Toronto.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Edmonton, Alta. — The Edmonton Metal Works have started the erection of their new factory.

Kenora, Ont.—The Vapo Stove Co. are making Vapo oil-gas burners. R. J. Cox is the inventor.

Young, Sask.—The North American Machinery Co. will build a warehouse here and handle all kinds of machinery.

Bridgeburg, Ont.—D. T. Johnston, of Toronto, is at the head of a syndicate who propose building a factory here for making automobiles.

St. John, N.B.—It is reported that a company will establish a structural steel plant here, if assistance can be obtained from the city. Mr. H. Ewing, of Wetherby, Pa., is interested.

Windsor, Ont.—The Canadian Thurber Rotary Co. is to start operations here to manufacture rotary valve motors and an attachment for inflating automobile tires.

Niagara Falls, Ont.—The Davis Acetylene Gas Machine Co. has contracted to manufacture metal locker cabinets in its factory here for the Canadian Automatic Parcel Checking Co.

Fort William, Ont.—C. P. McLennan of Halifax, N.S., is engaged in promoting a company which will be known as the Anglo-Canadian Locomotive Co. The company will erect a plant here for building locomotives.

Thorold, Ont.—F. J. Anderson and R. H. Ford have purchased the Stewart Foundry, and will operate the business under the name of the Thorold Iron Works. They will manufacture contractors' plants, hoisting engines, etc.

Gananoque, Ont.—The Ontario Steel Products Co. has purchased from the Rathbun Company a strip of land near the Jones Shovel plant. The land will be utilized for the erection of an addition to the finishing department of that establishment.

Ingersoll, Ont.—A special meeting of the council was held on March 28, at which a by-law to provide for a loan of $15,000 to Wilson & Short, and to authorize the taking over by that firm of the Standish agreement, was given a first and second reading. The voting on the by-law will take place on Wednesday, April 22.

Hamilton, Ont.—The engineers of the Chicago financiers behind the United Gas & Fuel Company, are in the city. They have approved of extensions to the old Hamilton Gaslight Co.'s plant to cost $50,000. The company is asking a reduction in the duty on coal that will be used for the manufacture of coke, and promise to expend at least $2,000,000 on a plant if it secures the reduction.

Thorold, Ont.—Voting took place on April 2 in Thorold Township on a by-law to grant James Battle, as trustee for the Exolon Co., a fixed assessment of $5,000 for a term of ten years on five acres of land adjoining the town of Thorold. The by-law was carried by a majority of 250. The Exolon Co., which will manufacture artificial abrasives, will break ground for the erection of their plant in a few weeks' time.

Electrical

Galt, Ont.—It is probable that a sub-station will be built here to take care of the increased demand for hydro-electric power.

Grand Mere, Que.—It is announced that work will shortly be started on the construction of the power plant of the Laurentide Co.

Woodbridge, Ont.—A by-law will be voted on by the ratepayers on April 11 to authorize the council to raise $6,000 in debentures for a hydro distributing plant.

Ottawa, Ont.—As the result of objections made by the Ontario Hydro-Electric Commission to the Niagara & Welland Power Co.'s bill for permission to make extensions, etc., the bill has been withdrawn.

Peterboro, Ont.—The Provincial Legislature has decided that the city cannot be forced into buying the Auburn Power Company, which is a subsidiary of the Peterboro Light & Power Company. The city will take over the latter.

St. Catharines, Ont.—By arrangement with the Ontario Hydro-Electric Commission, the line of the Ontario Power Co., which supplies power to several manufacturing concerns in St. Catharines, has been turned over to the St. Catharines Hydro Commission, and the rates will hereafter go into their treasury.

Municipal

Berlin, Ont.—The Berlin Light Commission have decided to erect a gas holder at a cost of $40,000.

Vancouver, B.C. —It is understood that the city will purchase a fire boat for fire protection on the waterfront.

Cobourg, Ont.—Stirling has organized a Board of Trade with Mr. J. B. Morton as president, and Mr. F. Ward, secretary.

Hamilton, Ont.—The controllers have approved of a by-law authorizing an issue of $125,000 of debentures for water works extensions and improvements.

Brampton, Ont. — A by-law will be voted on by the ratepayers to authorize a grant of $20,000 in bonds and exemption of taxes to the Imperial Iron & Steel Co.

Moose Jaw, Sask. — The voters of Moose Jaw will be required to cast their ballots for or against nine by-laws, involving the expenditure of $393,800, on April 24.

St. Catharines.— The St. Catharines Water Commission on March 31, decided to purchase a chlorination plant for the city water system at a coast of approximately $6,000.

Lumsden, Sask.—The town council are considering the question of taking over the lighting and power plant from the local company at a cost of $23,000. The plant consists of a Diesel engine, pumps and electrical apparatus.

Ottawa, Ont.—Owing to the increased consumption of municipal electric power and current it has been found necessary to enlarge the municipal plant on Laurier avenue. The extensions will be made this spring. The plant will be extended back as far as the canal.

Portage la Prairie, Man. — William Richardson announced recently that negotiations are under way with the representatives of the Bull Tractor Engine Co. to locate in the city, and, although nothing definite is yet to hand, it is understood that Portage has a good chance to land the big industry.

Electrical Driving of Winding Engines and Rolling Mills*

By C. Antony Ablett, A.M. Inst. C.E. and H. M. Lyons, A.M.I.E.E.

Each inroad made by electricity into fields long held by the steam engine usually marks a distinct advance in engineering science. The authors show that the electrification of mine hoists and rolling mill machinery is not only fully as feasible as that of railways and other well-known applications, but that it has much greater flexibility in admitting of automatic control, safety devices, etc.

APPLICATION TO ROLLING MILLS.

NEARLY 60 large reversing mills are being driven electrically in different parts of the world, and a modification of the Ward-Leonard system has been installed in almost every case to meet these special requirements.

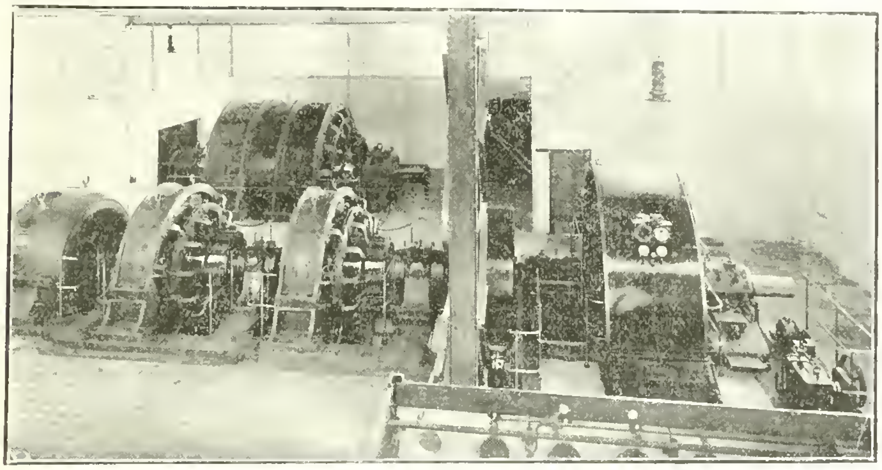

FIG. 7. GENERAL VIEW OF THE ELECTRICAL PLANT FOR DRIVING A 36-INCH REVERSING BLOOMING, ROUGHING AND FINISHING MILL AT THE SKINNINGROVE IRON WORKS. THE 12,000 HORSE-POWER REVERSING MOTOR WILL BE SEEN IN THE BACKGROUND. THE ILGNER MOTOR GENERATOR SET IS IN THE FOREGROUND, CONSISTING OF A THREE-PHASE MOTOR, TWO VARIABLE VOLTAGE DYNAMOS AND A 46-TON FLYWHEEL.

The power requirements of a reversing rolling mill impose much more severe conditions on the electrical plant than those of a large electrically driven hoist. With a large 36-in. or 45-in. blooming mill, ten to twelve passes are often made in a minute, and the power during individual passes may rise to 12,000 h. p. or more, while the total time of the passes, i.e., the total time that the ingot is between the rolls is very short compared with the total time taken to roll an ingot down to a bloom or billet. It is thus easily seen that the average power required from the power station is very much less than the maximum power which the mill motor has to give. For example, in many electrically driven blooming mills, the average power is only one-sixth or one-seventh of the maximum power. The diagrams in Fig. 12, in which the triangular or rectangular spaces show the work done per pass, illustrate how small the average power is, compared with the maximum power which has to be given by the mill motor.

In the case of an electrically driven hoist, the duration of a wind would be perhaps one minute, followed by a pause of 20 seconds or so, and the maximum power required seldom exceeds 3,000 to 4,000 horse-power, so that the average power is of the order of one-third of the maximum power. While, as has already been pointed out, it is frequently necessary to employ flywheels with winding engines it is always necessary to couple a flywheel to the motor generator set which supplies a reversing rolling mill motor, and to make provision so that the motor generator set falls in speed when the mill motor requires a heavy power to enable the flywheel to give up some of its power and then rises in speed again when the mill motor is not requiring power, thereby using the supply of the power house to store up energy in the flywheel. Experience has shown that in a steel works where electrical power is being generated in a blast furnace gas engine power station, the flywheel of the motor generator set has a very beneficial effect in keeping down the cost of this power station.

The flywheel of the motor generator set can be arranged so that it not only reduces fluctuations in the demand of power made by the mill motor to a minimum, but is also capable of reducing or even obviating peaks of short duration in the power demand, which may occur in other parts of the plant which are supplied from this power house. This is particularly the case where direct current power is being supplied. As the blast furnace gas engine has a very small overload capacity, this will obviate the necessity of running extra generating sets in order to take care of the peaks, and it will, therefore, both enable the total installed horse-power of the power house to be kept to a minimum, and will also keep down the running costs.

FIG. 8. GENERAL VIEW OF 36-INCH ELECTRICALLY DRIVEN REVERSING BLOOMING MILL AT THE SKINNINGROVE IRON WORKS.

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*Abstract of paper read recently before the Canadian Society of Civil Engineers, Montreal.

A reversing rolling mill motor, on account of the rapidity with which it has to reverse, must be so designed that its moment of inertia is kept down to a minimum and special precautions must be taken to see that the field of the generator supplying this reversing motor should build up as rapidly as possible. This has been accomplished so successfully that it has been found possible to reverse a large reversing mill motor having rotating parts weighing over 70 tons, 30 or 40 times per minute between a speed of 60 revolutions in one direction and 60 revolutions in the other, when no steel is being rolled. Such tests naturally cannot be made while steel is being rolled because it would be quite impossible with the present type of live roller tables to return the ingots to the mill quickly enough, but such tests are useful in showing the very high rate of acceleration of the mill motor which can be obtained, and as a measure of the handiness of the mill.

Power Diagram for Reversing Blooming Mill.

Under ordinary conditions the power diagrams for each wind of a hoist are identical and can be calculated with considerable exactitude from the conditions of working, but with a rolling mill the power diagrams for each pass vary very greatly from one another, and cannot be calculated with any accuracy, for the following reasons.

During the earlier passes heavy drafts are taken, but the ingot is quite short, consequently large powers are required for very short times; but as the ingot is gradually rolled out to a bloom of considerable length and reduced in section, the drafts are diminished, as the reduction in area must be kept moderate, otherwise the bloom is damaged by the formation of surface cracks, etc., so that during the last passes the necessary power is not very great, but it is required for a considerable time.

During the first two or three passes the ingot still has its tapered shape and the metal is very spongy in character, so that the powers required are not very heavy and are very irregular. By the time that the last passes are taken the bloom has cooled down considerably and while this cooling increases the specific power required, such drafts are taken that the power required for these remains much less than that for the first passes. In a blooming mill the draft in each pass is regulated by screwing down the rolls, which brings in a personal element, so that it does not follow that the power diagrams for the rolling down of successive ingots resemble one another very closely, and in addition, ingots do not always come to the mill at the same temperature, which also brings in variations in the power diagrams for successive ingots.

It will be seen that in the design of the electrical drive for reversing rolling mills, experience and judgment play a larger part than calculation, and in any case a good margin should always be allowed to insure that the mill is not underpowered. Many tests have been carried out on electrically driven reversing mills to obtain data for the work done in rolling the various sections. Experience has shown, however, that such data should always be accepted with caution, for even where tests are made on the same mill, rolling the same material under conditions which are as similar as it is possible to reproduce in practice, considerable differences are found in the work which has to be done in rolling down the ingots, because the slight differences in the speed of rolling, in the time taken between passes, etc., which cannot be avoided in practice, have a considerable effect on the results obtained.

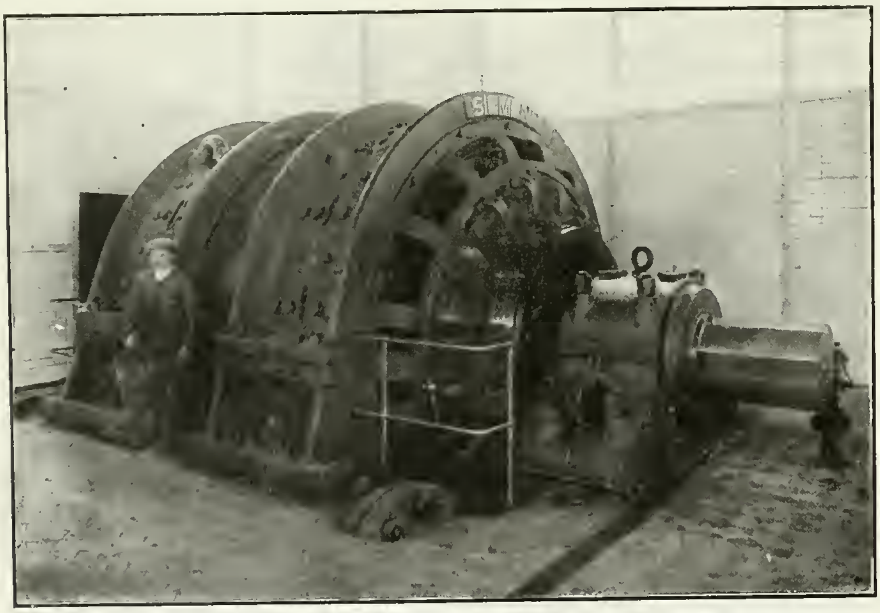


FIG. 9. A REVERSING ROLLING MILL D.C. MOTOR AT SKINNINGROVE, 12,000 HORSE-POWER, AT 60 R.P.M.; MAXIMUM SPEED, 120 R.P.M. TOTAL WEIGHT ABOUT 200 TONS. WEIGHT OF REVOLVING PARTS, 72 TONS.

Action of Flywheel.

There is a great difference between the behavior of the flywheel coupled to the motor generator set used for driving a hoist, and that used for driving a rolling mill. In the case of a hoist where the power diagrams for each successive wind are almost identical, and about an equal period elapses between each wind, the flywheel gives up power during a wind and regains it during the interval, thus serving to equalize the power between individual winds and intervals.

In the case of a rolling mill, and particularly a blooming mill, the flywheel has to do a double duty, because, during the first passes made on an ingot, the mill motor has to give a large power for a very short time as the ingot is short, so that the energy consumption during the earlier passes is much less than the energy consumption during the later passes, where, although the power given by the motor is not so great, the ingot has been rolled out to a considerable length, so that a very considerable energy is required per pass. The flywheel, therefore, has to give up energy during the passes and regain it during the interval between passes, and also the flywheel gains energy during the first passes of an ingot and loses energy during the later passes, so that its speed variation has a double period, namely, a short period of about 5 to 10 seconds, corresponding to the partial equalization of power between the pass and interval, and a long period of about 3 minutes corresponding to the equalization of power over the whole time of rolling an ingot.

As the flywheel used in connection with a rolling mill has to equalize the power over a period of three minutes or so, it is usually found that these flywheels are much heavier than those applied to winding engines. The motor generator set for a blooming mill is usually supplied with a flywheel weighing about 40 tons, while a motor generator set provided for a plate mill, or a finishing mill, is generally supplied with a flywheel weighing anything from 60 to 100 tons, depending on the work which has to be done. The motor generator set for supplying hoists or winding engines is generally provided with a flywheel of not more than from 20 to 30 tons. Such flywheels would run at a peripheral speed of about 20,000 per minute, though in some cases this peri-

pheral speed has been considerably increased. A 100-ton wheel running at this speed would have a stored energy of about 300,000,000 foot lbs. or 545,000 horse power seconds, and in falling 20% in speed would give up 108,000,000 foot lbs. or 195,000 horse power seconds. The total work required to roll a $1\frac{1}{2}$ ton ingot to a $4\frac{3}{4}$ x $4\frac{3}{4}$ billet is 59,000,000 foot lbs. or 108,000 horse power seconds.

brakes would prevent the cage falling in the shaft when the breaker opened, but with a mill, when the circuit breaker acts the motor merely comes promptly to a standstill, and if there is an ingot between the rolls, the mill can be reversed, the circuit breaker put in, the ingot run out of the mill again, and no damage is done. This circuit breaker can either be operated instantaneously by a maximum current cut-out in the main circuit or else opened by a lever under the control of the driver. In the latter case, the field currents in the generator and motor field are reduced to zero before the circuit breaker operates; in practice this hand lever is seldom used.

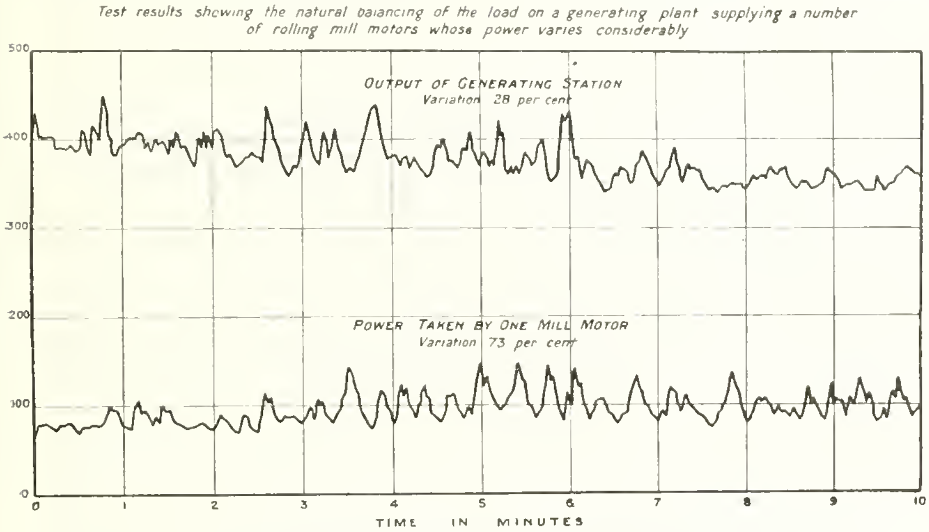


FIG. 10. TEST RESULTS SHOWING THE NATURAL BALANCING EFFECT ON THE GENERATING PLANT OF THREE ROLLING MILL MOTORS WHOSE POWER VARIES CONSIDERABLY.

Safety Devices.

The safety devices provided for an electrically driven rolling mill are of a much simpler character than those provided for a hoist, because it is not necessary to provide against the possibility of an overwind or the loaded cage falling to the bottom of the shaft due to the failure of the electric power. It is only necessary to protect the electrical plant and the mill itself against careless handling.

Shell couplings are usually provided to couple the pinion wobblers to the leading spindles to prevent the motor or pinions being shifted from their bedplate by axial thrust due to a broken roll. This feature is usually also introduced into well designed steam driven mills. A circuit breaker is provided in the main circuit between the generator of the motor generator set and the mill motor to cut off the power from the motor in case, through carelessness, an attempt is made to roll a cold ingot, or too great a draft is taken on an ingot, imposing a greater strain on the motor and mill than they were designed for.

The circuit breaker is a protection against broken rolls as well as against damaging the motor, and it must be remembered that many rolls, especially the bottom roll, have a very small factor of safety. Such a circuit breaker would be most objectionable if used with a hoist, as only the prompt application of the

During the latter passes, when the ingot has been rolled out to a bloom of considerable length, there is time to accelerate the mill to a much higher speed than is possible when rolling a comparatively short ingot, and this is desirable in order to get the work done as quickly as possible, while, as the section has become much reduced and the draft is small, a relatively small turning moment is required. The mill motor is of course accelerated to the maximum speed at which full turning moment is required by increasing the field of the variable voltage generator. The most convenient way of obtaining the additional speed without increasing the size and capital cost of the plant is by decreasing the mill motor field, though of course at the expense of reducing the possible turning moment, which decreases at a faster rate than the speed increases, but which, however, agrees very well with the requirements of the mill. There is always the possibility, however, of too heavy a draft being taken through carelessness when the mill is running at this high speed, causing an overload against which the circuit breaker would not offer proper protection. To prevent this, a relay is provided, which, when it operates, strengthens the motor field to its full value and reduces the motor speed to the maximum at which it can exert its maximum turning moment, thus both reducing the overload and putting the motor in a better position to meet it; but if the overload be still too great for the motor, the circuit breaker will open.

The purpose of the flywheel coupled to the motor generator set, as mentioned above, is to insure that the rolling mill plant takes an average steady power from the power station irrespective of any fluctuations in power the mill may require, but the value of the average steady power depends on the work that the mill is doing, i.e., the output and the section that is being rolled. If the regulating mechanism be set for the maximum average steady power, corresponding to the heaviest work that is done in the mill, and then much lighter work is done, rolling slabs for plates for instance, the power taken will fluctuate considerably, but will not exceed the value of average power for which the regulator has been set.

As this fluctuation may adversely affect the regulation of the power house, means are provided to enable the regulator to maintain a lower value of average steady power, corresponding to the work that is being done. If the regulator be set for this lower value, and heavy work is again done in the mill, the surplus power will be drawn from the flywheel to give the necessary energy, the speed of the motor generator set will sink lower and lower till at last the flywheel, whose store of energy is proportional to the square of its speed, will not be able to supply enough power to drag the billets through the mill and the mill will stall. To prevent this, two colored lamps are provided on the driver's platform to signal the speed of the flywheel. The first one, the caution signal, lights up when the flywheel is about 22% below full speed, to warn the driver that the average power is inadequate to the work he is doing, and the regulator must be set to a higher value. The second, or danger signal, lights when the flywheel is 30% below speed, and warns the driver that if he goes on he will stall the mill.

A good deal of space in this paper has been devoted to description of safety devices but it should not be considered on this account that there is any inherent risk in using such electrical plant, as the safety devices are to protect the plant against damage due to careless handling. The devices applied to steam hoisting engines, and particularly to steam reversing rolling mill engines, are of a much more rudimentary description.

and the safety of such steam plants really depends on the skill and experience of the driver. It should be particularly pointed out that the electrically driven reversing mill does not increase in speed as the ingot passes out of the rolls, while the steam engine, unless carefully handled, will race and run away.

Three-High Mills.

The authors have selected the electrically driven blooming mill as an example, and space unfortunately does not permit the discussion of the modification of the Ward-Leonard system to suit the requirements of plate mills and finishing mills. It is, however, important to mention that there is an increasing tendency in Europe to use the Ward-Leonard system for the driving of three high finishing mills, instead of a continuous running motor and flywheel coupled to the mill. The reason for this is that the Ward-Leonard system enables a much greater output to be obtained from the mill, because the bars may be entered at a low enough speed to prevent damage being done, and, as soon as the rolls have gripped the bar, the speed is run up to a maximum and diminished again so that the bar leaves the rolls at a reasonably low speed.

As a 100-lb. rail rolled from a 4½-ton ingot finishes about 90 ft. long and bulb angles and channel often finish 200 ft. long, the saving in time which may be effected can be appreciated, and as this enables the material to be finished much hotter, the work done in rolling, and consequently the cost of power, and reduced. Where a three-high mill is driven on the Ward-Leonard system it is found that there are far fewer broken rolls than when it is coupled to a continuous running motor and flywheel. These advantages are found in Europe to outweigh the increased capital cost of the plant.

Safeguarding the Human Factor.—"Hereafter all promotions of whatever character will be made only from the ranks of those who do not indulge in the use of intoxicating drinks. The heads of departments and the foremen will be expected to enforce this order in advancing their men." This official order, recently posted in the mills of the Carnegie Steel Co., in the Youngstown district, is in line with the elaborate system of that company to maintain the efficiency and safety of the men of its mills. It illustrates the effort of large employers to reduce the fallibility of the human element in industrial accidents. An unsteady hand or a confused brain, where alertness is required, may mean the injury not only of the one thus affected, but serious disaster to his fellow-workmen as well.—Ex.

Jig Bushing Design, Construction and Application

By F. Scriber

THE proper bushing to use for guiding a drill, reamer, counterbore, or tap when making jigs is a question that comes up on almost every job, and it is the purpose of this article to show some

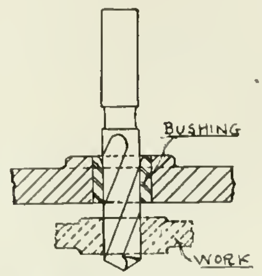


FIG. 1. METHOD OF GUIDING DRILL IN PLAIN BUSHING.

of the combinations which give good results. In addition, tables of bushings and locks are also included as a guide to the general run of these tools. These

In the latter, (A)—is a drill with a stop collar used for spotting the hole as shown and is a running fit in the slip bushing (B). The next view shows the slip bushing removed and a drill (C) being used to drill a hole, the same fol-

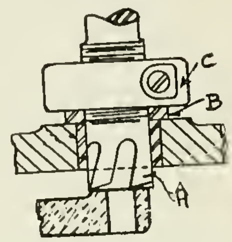


FIG. 4. COUNTERBORE WITH STOP COLLAR USED IN LINING BUSHING.

lowing in line with a spot. Another slip bushing (D) is shown in place, while a hole is being reamed by reamer (E) which is a running fit in the bushing.

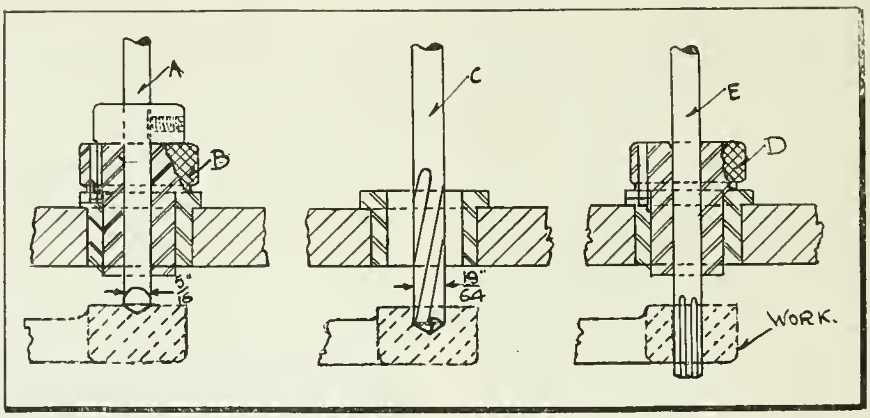


FIG. 2.

Spot drill with stop collar used in slip bushing. Reamer drill guided only by spot. Reamer used in slip bushing

bushings are sometimes carried in the cover of the jig, the main frame of jig, or both, and are used as shown by Fig. 1, for guiding a plain drill while making

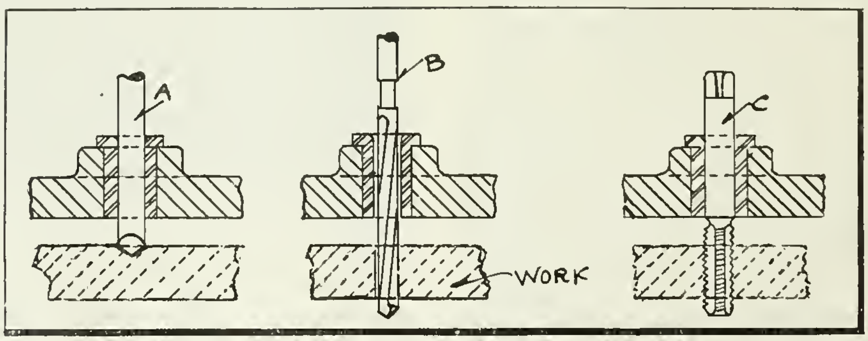


FIG. 3.

Spotting the hole. Drilling the hole. Tapping the hole.

a hole, or are used in numerous combinations, of which Fig. 2 is an example.

An example of the spot drill and tap method of using bushings is shown by Fig. 3. There is but one bushing in this case which is a collar head bushing with a hole of diameter equal to the outside diameter of the tap, while the spotting drill (A) is of the same diameter as the

tap outside and is followed by a tap drill (B). The hole is afterwards tapped at (C). The use of a counter bore or facing tool with a stop collar on it

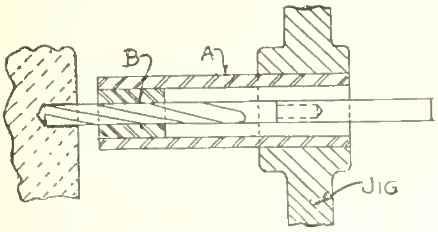


FIG. 5. EXTENSION BUSHING USED WHERE LONG REACH IS REQUIRED.

is shown by Fig. 4. where (A) is the facing tool, and bushing (B) with collar (C) is shown down flush on the bushing head, being used as a stop.

BUSHING LIST							
LOCATION	No. REQ.	STYLE	HOLE A	HOLE LAP FOR	LENGTH	SLOT IN HEAD	NUMBER
3	3	1	1/4	1/4 DRILL	3/4	–	E-113 A
7	2	2	7/8	9/16 SLIP BUSHING	1 1/8	YES	E-113 B
8	1	3	9/16	9/16 REAMER	1"	–	E-113 C
11	2	2	3/4	3/4 C'BORE	1 5/8	No	E-113 D
20	1	1	1 1/16	1 1/16 TAP	1 1/2	–	E-113 E

FIG. 6. BUSHING LIST.

It sometimes happens in the construction of jigs that the distance from the frame of the jig to the work is quite

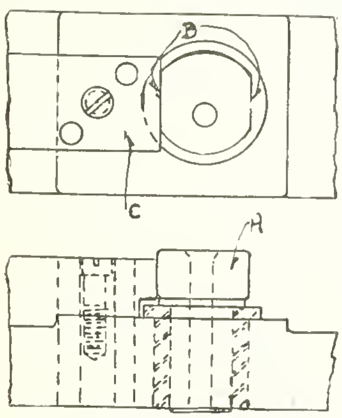


FIG. 7. METHOD OF LOCATING ECCENTRIC BUSHING.

a distance, and it therefore becomes necessary to use an extension bushing similar to that shown by Fig. 5, which

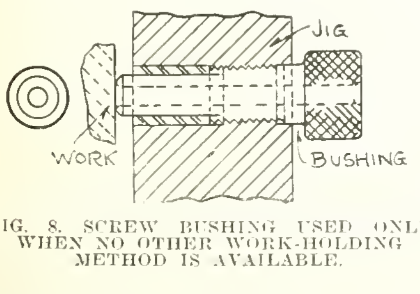
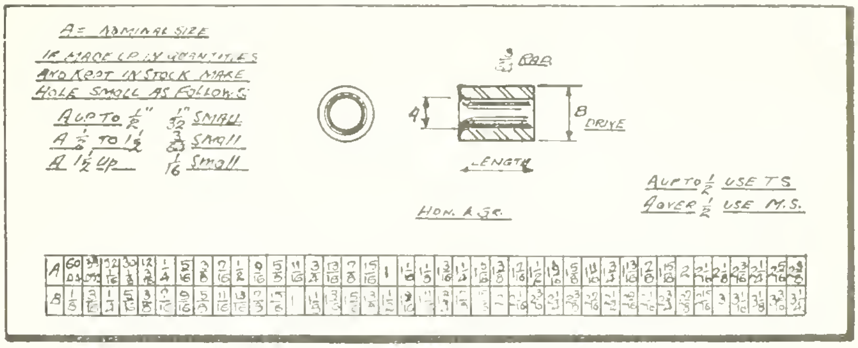


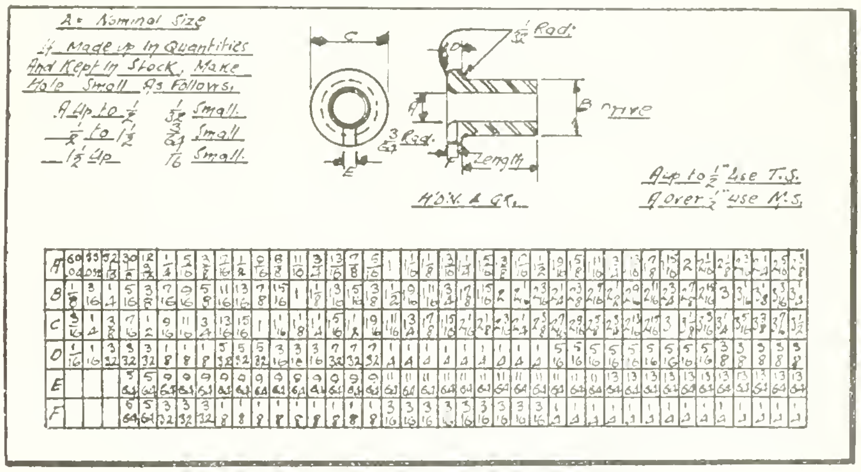
FIG. 8. SCREW BUSHING USED ONLY WHEN NO OTHER WORK-HOLDING METHOD IS AVAILABLE.

consists of two bushings (A) and (B), the long one (A) being used to carry the short one (B) up near the work where the drill should always be supported. In connection with these bushings, styles I, II, III, show proportions



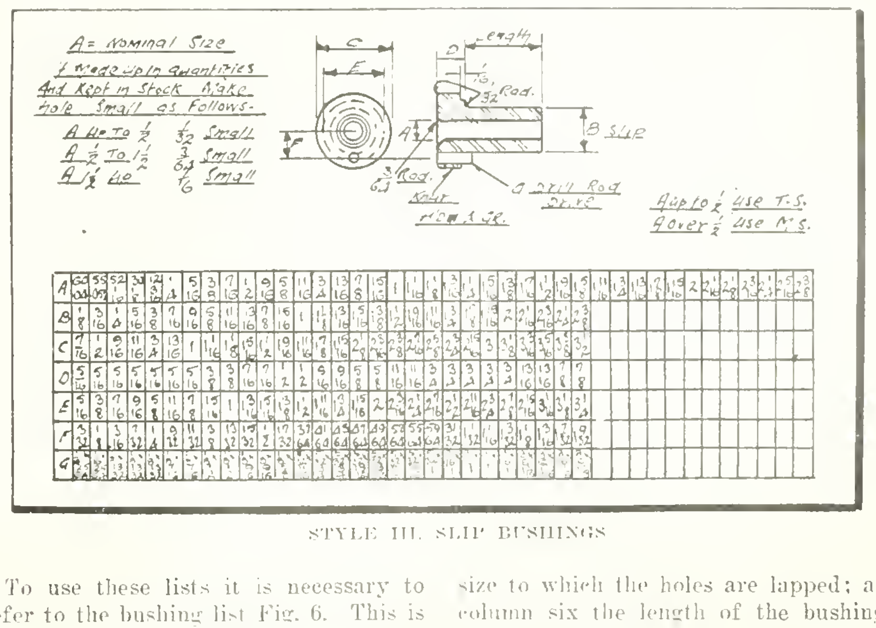
STYLE I. PLAIN BUSHINGS.

which are good practice. Style I refers to plain bushings; style II to collar head bushings, and style III to slip bushings.



STYLE II. COLLAR HEAD BUSHINGS.

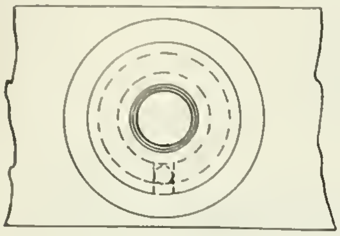
All are made from tool steel up to half inch, and from machine steel over half inch, although tool steel is often used for all sizes.



STYLE III. SLIP BUSHINGS.

To use these lists it is necessary to refer to the bushing list Fig. 6. This is placed on the drawing of the jig. The first column gives the location by number of the bushing in the jig, the second column gives the number of bushing required, the third column the style of bushing, whether one, two or three as shown by the lists, the fourth column (A) corresponds to a similar dimension on the bushing lists, and is the governing factor from which all other dimensions are taken. Column five gives the size to which the holes are lapped; and column six the length of the bushings, this being purposely omitted in the

tables as it varies according to conditions. Column seven specifies yes, or no, to the question, "slot in head," which is explained later, and the last column is for designating the bushing



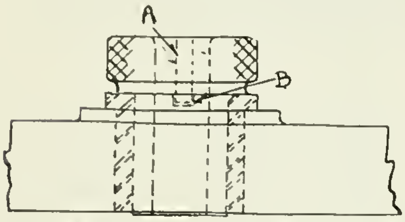
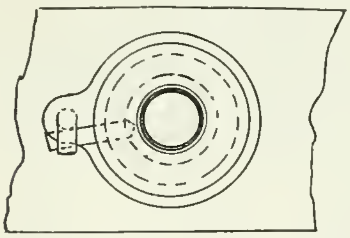


FIG. 9. METHOD OF LOCKING BUSHINGS SHOWN IN THE TABLES.

in its proper connection with the jig by a number.

Another method which can be used for drilling two eccentric holes is shown by Fig. 7, and consists of a plain slip bushing (A) which has the hole that guides the drill placed off centre and is flatened off on the sides at (B) to butt against a block for locating (C). The manner of using is obvious from the sketch, as the first hole is drilled with the bushing in the position shown, while, to drill the other hole, the bushing is turned half way round and the flat at



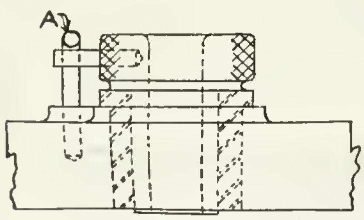
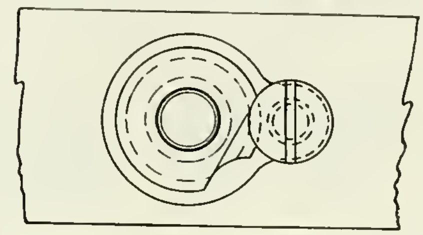


FIG. 10. BENT PIN METHOD OF LOCKING BUSHING.

the opposite side placed against the block to drill the hole. This method is often used to make a slot, as, when the two holes are drilled, the metal between the holes can be filed or broached away to make the slot. The last bushing shown is a screw bushing Fig. 8. This is mostly used to hold work in place and guide the boring tools at the same time. It is made to screw down on the work in a manner which can be readily seen from the illustration.

Next in importance to the correct bushing to use for the best results is a suitable lock to hold slip bushings in place, and while these vary considerably, four good locks are here shown. The first of these Fig. 9 is the style of lock which is shown in the tables of bushings illustrated and by referring to the sketch, Fig. 9, the manner of application will be apparent. The pin (A) in the slip bushing, fits into the slot (B) in the fixed bushing; the slip bushing is thus prevented from turning with the drill or whatever cutting tool is being used. This lock is quite satisfactory where the metal being cut is cast iron, but, with steel or other metal which gives a long stringy cut it is not reliable, as there is



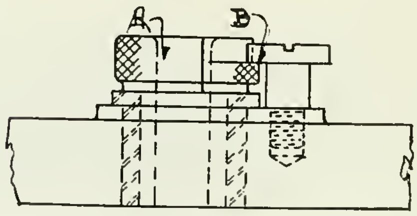
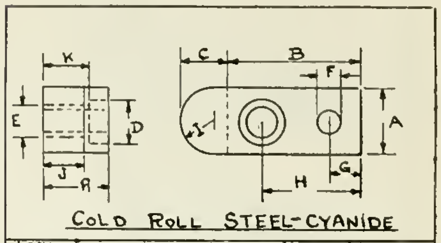


FIG. 11. BUSHING LOCKED IN PLACE BY STUD.

nothing in its construction to prevent the slip bushing from being pushed out.

In the bushing list, Fig. 6, reference was made to a column in which it is necessary to answer "yes" or "no" to the question, "slot in the head" of the bushings style II. This means that if the bushings are to be used with slip bushing style II, and the style of lock mentioned above, they will require a slot, and the column will require the answer yes; its opposite, of course, being no. For the other style bushings the column is left blank or has a dash placed



LOCK NUMBER	1	2	3	4	5
A	5/16	7/16	9/16	5/8	3/4
B	7/8	15/16	1	1 1/4	1 1/2
C	3/16	1/4	11/32	13/32	1/2
D	13/64	17/64	25/64	29/64	37/64
E	9/64	13/64	17/64	21/64	25/64
F	1/8	3/16	3/16	1/4	1/4
G	3/16	7/32	1/4	5/16	3/8
H	11/16	23/32	3/4	15/16	1 1/8
I	5/32	7/32	9/32	5/16	3/8
J	7/32	5/16	3/8	27/64	15/32
K	5/32	7/32	9/32	5/16	3/8

FIG. 13. STANDARD LOCKS FOR USE WITH SLIP BUSHINGS.

in it, this being equivalent to non-recognition.

A good lock which can be used when machining any metal is shown by Fig. 10, and consists of a bent pin (A) placed in the jig to hook over a plain pin in the slip bushing in the manner shown; the bent pin being placed on the side of the plain pin where it will resist the action of the drill. The use of a stud screw for locking a bushing in place is shown by Fig. 11. This is used to hold both the bushing from turning and from coming out of the jig, the bushing head (A) being cut to receive the screw at (B).

A somewhat more expensive form of bushing lock but a very good one is shown working under two conditions in Fig. 12, while a table of proportions for same is shown by Fig. 13.

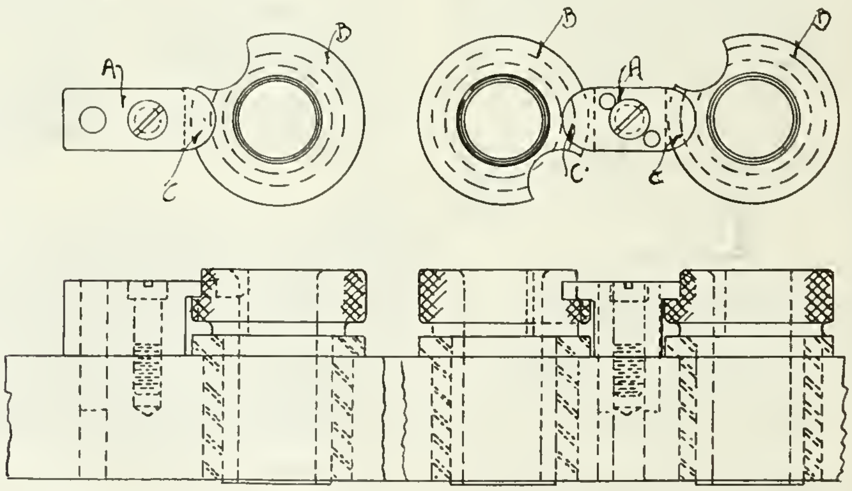


FIG. 12.
Method of locking single bushing with block. Two bushings locked with one block.

Safety Provisions Relative to Transmission Machinery—I.

By W. Sydney Smith.

An official report by the Inspector for Dangerous Trades in England, regarding fencing and safety precautions for transmission machinery, has been issued. It explains the structural and administrative safeguards with regard to the several parts of transmission machinery which experience shows to be needed for the protection of persons employed where such machinery is used.

It is a dangerous fallacy to assume, as is often done, that slow-running shafts, or shafts of large diameter, are free from danger and need not be safeguarded. Every shaft is required by the Factory Acts to be securely fenced, irrespective of its speed or size, unless it be equally safe by position or construction as if it were fenced. Unfenced smooth shafting of 12 ins. in diameter and shafts running at less than 26 revolutions per minute have been responsible for fatalities. The following rules should apply to horizontal, vertical and oblique shafts:—

(1)—Shafts less than 6½ ft. above the floor level should be securely fenced.

(2)—Shafts more than 6½ ft. above the floor level should have those parts securely fenced which are less than 6½ ft. from any point (work bench, platform, shelf, cupboard, machinery, boiler, plant, pile of goods, ladder or other structure, to which workers may need occassional acess for such purposes as lubrication, cleaning, manipulating belts, or other work of maintenance of transmission machinery; lime-washing, painting, electric wiring, cleaning, opening or shutting windows, or any occasional work other than the work of maintenance of transmission machinery, except where the shaft is stopped at the time any worker approaches within 6½ ft. of it, or the shaft is moving at less than six revolutions per minute at the time any worker approaches the transmission machinery for the purpose of adjusting belts, and due provision is made (by signals or otherwise) for prompt stoppage at the first sign of danger.

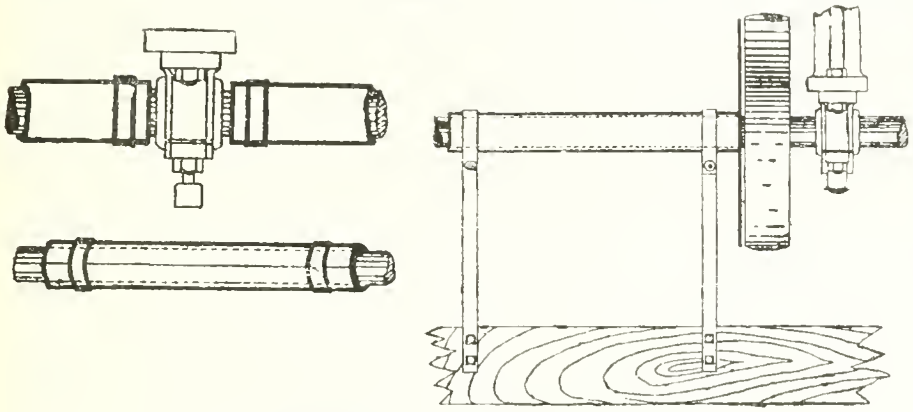


FIG. 1. SHEET METAL OR MILLBOARD TUBES.

These rules are embodied in the proposed regulations requiring shafting and other parts of the transmission machinery "within reach" to be securely fenced, if in motion, and the phrase "within reach" is defined as meaning "within a distance of 6 ft. 6 ins. in any direction from any spot on which any person employed or working may have to stand or pass at any time, either in the course of his employment or incidentally thereto."

Measuhement in an upward direction only will not suffice. Dangerous transmission machinery may be "within reach" in a horizontal or even downward direction from the working place of a person employed—for example, it may be near or below the level of the floor on which he has to stand; or he may have to work at the edge of a pit or on a ladder, with risk of falling into unfenced transmission machinery below.

Although the definition makes no exception for an intervening fence of any kind, even a floor or wall, no difficulty can arise in practice since the requirement of secure fencing may be already met.

Type of Fencing.

The type of fencing needed varies with the position and arrangement of the transmission machinery, but shafts are usually fenced, either by complete or partial casings, consisting of fixed or loose sleeves, or by guard rails so placed as to prevent access. Tubes of sheet metal or mill board, Fig. 1, sheet metal troughs, Fig. 2, and wood casings, Fig. 3, make excellent guards. These may be attached by suitable brackets to such supports as pedestal bearings, hangers, wall-1boxes, overhead beams, walls or flooring.

Wire netting is sometimes similarly used, but is less cleanly than complete casings of sheet metal or wood. Millboard tubing, somewhat larger in diameter than the shafting, may be slipped over the shaft as a loose sleeve, which will revolve when the shaft is in motion, but will stop immediately if a person comes in contact with it. Millboard tubes are made of varying lengths, in halves or split on one side. The parts can be readily fastend together by means of thin wire or metal clips which should be free from projections. Loose metal sleeves are often similarly used

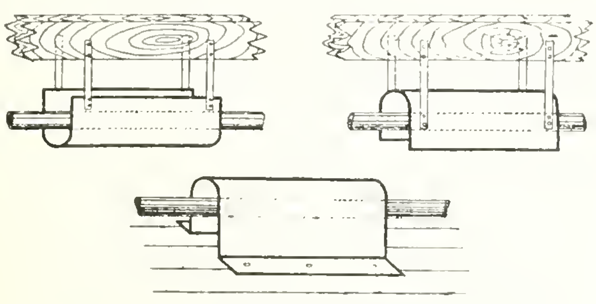


FIG. 2. SHEET METAL TROUGHS FOR PROTECTING REVOLVING SHAFTS.

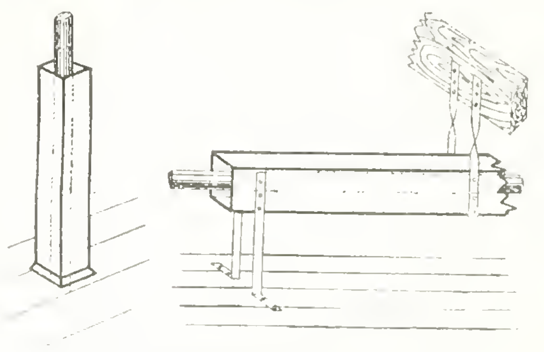


FIG. 3. WOOD CASINGS FOR PROTECTING REVOLVING SHAFTS.

for fencing shafting and projecting shaft ends.

When shafting is fenced with partial casings, care should be taken that the revolving shaft is covered sufficiently by the casing. Many accidents have occurred on shafts protected on two or three sides, only, leaving the shaft exposed in one or more positions. Shallow partial fencing, such as a trough or single board placed under, over, or adjacent to shafting, is dangerous. For this reason, complete casings are preferable to partial guards unless deep troughs of wood or metal are used.

In some instances, owing to the number of pulleys upon low lines of shafting, as in flour mills, saw mills, engineering factories, and similar works, the shafts cannot be encased. Guard rails are then necessary. The rails should not be too wide apart and the space between shaft and rails, whenever the diameters of the pulleys or the positions of the driving belts permit, should be about 12 inches. If it exceeds this, a person may enter within the space, and if less than this, accidents may happen through contact with the shaft by clothing or materials, or by persons falling against the rails.

In clothing factories, where sewing machines are generally driven by low shafting under the machine benches, the shafts and pulleys are often fenced by rods of iron or by fixed boards, and occasionally by hinged boards. The latter are dngerous, as there is always the chance of the workers throwing back the guard and coming in contact with the shaft. Where rails are used these should be sufficiently strong to resist bending if used as foot rests.

Care is necessary as to position of the guards and spacing of rails and boards to allow, with safety, the adjustment of driving bands and the necessary cleaning under benches, but at the same time to avoid the possibility of the hair being caught. Such accidents generally occur when a worker with loose hair is sweeping under a bench or picking up some object which has fallen on the floor in the vicinity of the shafting. It is usually found either that the guards were fixed originally too far apart, or that a rail had been bent downwards, leaving sufficient space for the head to approach the shaft and the hair to become entangled. A space of 8 inches between the floor and lowest guard, with spaces not exceeding 6 inches between the higher rails or boards, will not interfere with cleaning or manipulation of belts, and will almost entirely remove the risk of accident.

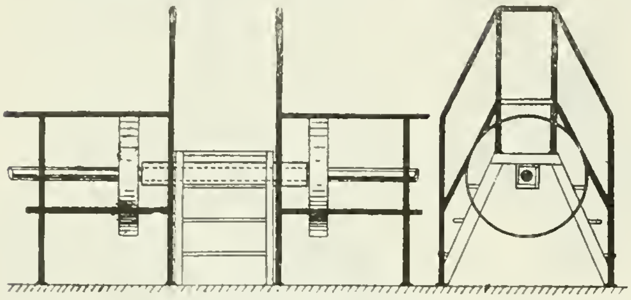


FIG. 4. FENCING FOR LOW SHAFTING WITH STEPS OVER SHAFTS AND HANDRAILS.

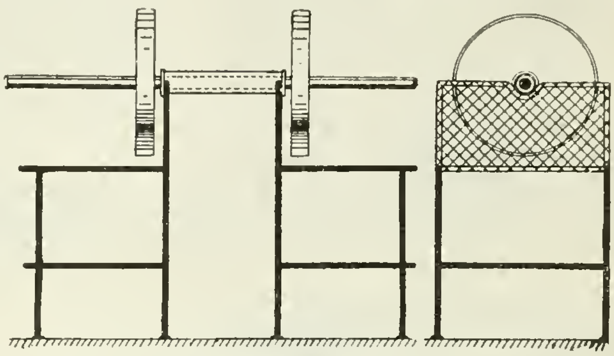


FIG. 5. FENCING FOR SHAFTING WITH FENCED PASSAGE-WAY UNDER SHAFT.

In the latest type of sewing machine benches, the machines are driven from a shaft, fixed a few inches below the bench, and completely encased in planished steel tubing; while the shaft is directly driven by an electric motor co-axial with the shaft. The fronts of the pulleys and bands driving the machines are fenced by cast metal grids. In general, where females are employed, greater care is needed as to the fencing of transmission machinery in order to avoid accidental contact of the worker's hair or clothing with revolving parts; complete encasing of shafting, with protection of pulleys by side plates, as shown in Fig. 1, is preferable.

Whenever it is necessary to cross low lines of shafting fenced by rails, there should be gangways or steps at suitable intervals so as to fence the shaft, with hand rails on either side of these crossing places (Fig 4). Where the shafting is high enough to allow passage underneath, but less than 6½ ft. from the floor level, the shaft should be completely encased at the passage way (Fig. 5).

High shafting in motion must be approached from time to time by engineers, greasers, beltmen and other persons employed in oiling, cleaning, adjusting belts and similar work of maintenance. Where space permits, there should be an overhead gangway or service platform, sufficiently near the shafting to admit of the necessary work being done in safety, and yet at such a distance as to prevent contact with transmission machinery in motion. The platform should have guard rails to a height of 3 ft. and a skirting board to prevent the worker falling under the rails or fall of tools on persons below. Failing overhead gangways, the approach may be made by a safe type of ladder, but in such cases there is always risk of accident unless the shafting in the vicinity be fenced.

High shafts are often permanently encased for about 2 ft. on either side of each bearing, the casings being fixed by suitable brackets to the bearings or hangers. Ladders are sometimes provided with an inverted trough, which rests on the shaft, and so fences the portion temporarily. These may be used where there is ample space between pulleys, couplings and bearings. If there be lubricators, or self-lubricating bearings, oiling can generally be done at rest, but replacing of belts on pulleys is impossible in many cases unless the shafting and pulleys are moving. With various types of belt mounters this operation can be done in safety from the floor level at the ordinary working speed of the shafting.

Where pulleys are close together, fencing of the shaft is often impracticable, and if the worker approaches unfenced transmission machinery in motion to adjust belts, in addition to contact with the revolving shaft, there is always the danger of contact between belt and pulley, or belt and shaft. Hence, in cases where approach to unfenced shafting is necessary, it is imperative that the speed of the shafting be previously reduced to a safe limit.

Severe accidents have occurred on shafting moving at only 9 revolutions per minute, and a fatal accident on a shaft moving at only 5½ revolutions per minute; but a speed not exceeding 6 revolutions per minute may be considered safe for the dangerous operations of manipulating belts by hand on transmission machinery in motion, provided due provision is made by signals or otherwise for prompt stoppage at the first sign of danger.

Goderich, Ont.—The new government revolving flashlight, placed on the highest elevation here, was lighted on April 7, for the first time. It proved highly satisfactory, and will no doubt be a great boon to mariners entering the harbor.

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

PUNCHING HOLES IN LIGHT PLATE.

By J. W. Ross.

IN shops not equipped with a power punch, or where the punch is situated a long way from the work, it is a common practice to punch holes in light plate by hand over a hardwood block or a nut. Placing the nut in exactly the right spot is a matter of some difficulty, especially if the hole to be punched be at some distance from the plate edge.

At one time, the writer had a number of 5-16 holes to punch in a plate 3-32 inch thick. This was a repeat job, and as the holes were not spaced exactly alike in each piece it was necessary to mark them off every time. The job was being done by piece work, and as the power punch was a long way from the place where the work was being carried out, much time was wasted taking the plates to it each time. To overcome this drawback, the writer devised the jig shown in Fig. 1, by means of which the job could be done in a few minutes with a great saving of time and money. The jig was made in less than an hour, during a lull in the work.

A die was procured from the boiler shop, and around it was bent a piece of flat iron, 1 x 1/4 inch. The iron was given a half-twist, as shown at (A) in Fig. 1, and was bent over so as to bring the upper bar in line with the die. A hole was then drilled in this upper bar to gauge the punch to the die. For punching the hole, a plate-marking teat punch was used, as shown at (B), Fig. 2. It was found an advantage for some jobs to remove the teat by grinding, and thus have a flat surface at the end of the punch, as shown at (C). A couple of hammer blows on the head of the punch quickly forces a hole through the plate, while a little oil greatly facilitates the work. After the hole is punched, a light blow on the side of the punch allows the latter to be readily stripped from the plate. Smaller holes may be punched by changing the die, an operation that may be quickly accomplished by means of the wing bolt shown in Fig. 2. If unable to obtain a marking punch, an ordinary drift pin may be ground to the desired size and shape on an emery wheel and afterwards tempered. This makes a very effective punch.

A more elaborate jig is shown in Fig. 3. The part containing the punch holes and dies is of tool steel, while the bent portion may be machine steel welded on. With this device, several sizes of holes can be punched without changing the dies. Heavier gauges of plate may be punched by using a punch with a handle, or by holding the punch with tongs, an assistant striking the punch with a light sledge.

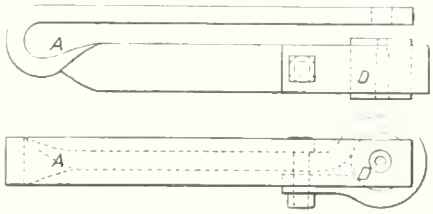


FIG. 1. PUNCH FIXTURE FOR USE WITH BUTTON DIE

As in the case of power punches, the punch should be slightly tapered as shown, to permit of clearance. The die is similarly tapered to allow the punchings to fall through. If the punch (B) be used for the fixture shown in Fig. 1, the one-sized guide hole can be used with all sizes of dies. It also has the advantage of not being so easily broken.

COLLET CHUCK OPERATED BY COMPRESSED AIR.

By H. C. Dunbar.

OF late years compressed air has been used in several machine shops to operate various forms of quick opening and closing chucks specially designed to assist in the rapid production of standard machine parts. The purpose of this article is to describe how a simple and useful collet chuck is operated by compressed air.

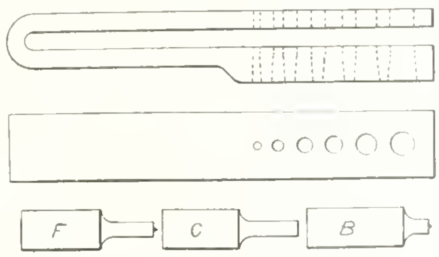


FIG. 2. PUNCH FIXTURE FOR DIFFERENT SIZE HOLES.

With reference to the accompanying sketch, the pull collet (A) is made of tool steel (hardened); the head is tapered on the outside to fit the tapered nose ring (B) of tool steel (hardened), which is pressed into the end of the lathe spindle. The bore of the nose ring and the outside of the collet head are ground after hardening to an angle of 14 degs. The back collar of the collet is ground on the outside to fit the bore of the lathe spindle; the collet is also threaded inside, as shown, to suit the thread on the pull rod (C), and is bored from the back to take the plunger (D) and the coil spring (E). The front end of the collet is bored to suit the article to be machined. The collet is turned down between the back collar and the head, and is sawn from the front, with two cuts at right angles, to within 1/4 in. of the back collar, so that the four segments thus formed are free to close upon the work, or to release the work, as the chuck is operated.

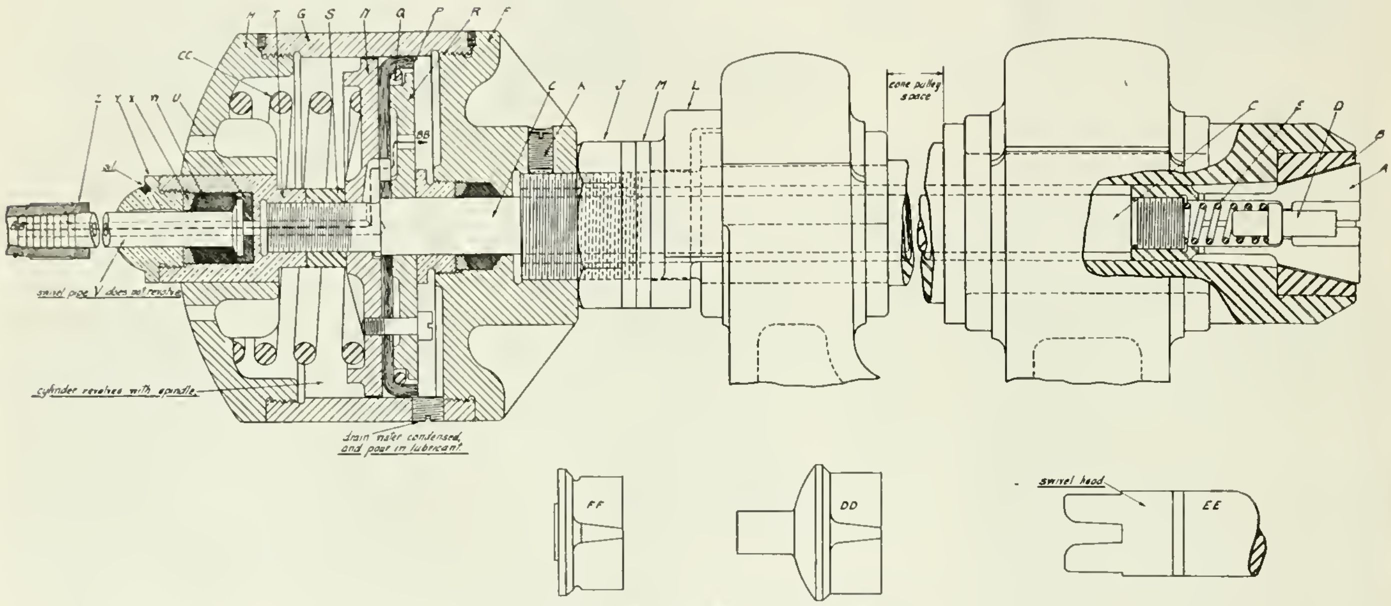
The cylinder is made of cast iron in three parts—the pressure head (F), the barrel (G), and the non-pressure head (H). These three are screwed together, as shown, and a dowel is screwed into each joint to prevent the parts from unscrewing when the lathe is reversed. The pressure head (F) is screwed on to the lathe spindle, and is secured by a jam nut (J) and by one or two tool steel set screws (K) with cupped points. The jam nut (J) acts also as a thrust nut to take up the end play of the lathe spindle. Between the thrust nut and the thrust cap (L) there runs a loose ring of hard fibre (M). This eliminates much of the wear which would be caused by the friction of the steel thrust nut on the thrust cap.

The piston is made up of four parts—the cast iron piston head (N), the cupped packing leather (P), the packing leather expander (Q), and the cast iron piston follower (R); (N), (P), and (R) are bound together by four machine screws. The expander (Q) is loose between the leather and the follower. It is made of round steel wire, rolled to form a ring slightly larger in outside diameter than the inside diameter of the leather; a small piece being cut out of the ring so that when contracted and placed inside the cupped leather the ring will expand, when released, and press the leather against the wall of the cylinder, in this way preventing the compressed air from passing the piston. The ring is assisted in its office by the compressed air which, when admitted to the front end of the cylinder, forces the leather outwards against the cylinder wall. The piston is secured to the pull rod (C) by the nut (S), which is locked by the stuffing box (T).

The stuffing box (T) is free to move

lengthwise in the non-pressure head (H). Inside the stuffing box is a fibre washer (U), against which butts a steel swivel pipe (V). The graphite packing (W) is held in place by the ring (X) and the nut (Y). To the swivel pipe is attached a short length of air hose (Z) bent "L" shape to allow for the straight-line motion of the piston. The swivel moves back and forward with the piston, but does not revolve, and the hose is stiff enough to overcome the twisting tendency of the swivel caused by the friction of the packing. Compressed air enters the cylinder in the direction of arrow (AA), (BB), while the supply of air is controlled by an ordinary straight stop-cock with a vent hole in one side, so arranged that when the air supply is cut off the exhaust from the cylinder escapes through the vent holes. In order that then admitted to the cylinder. It forces the piston back, the coil spring (CC) is compressed, and the collet (A) being pulled backwards into the tapered nose ring (B), closes upon the valve shank with a powerful grip. The valve commences to revolve with the spindle, as does also the swivel head of the valve holder. The turret is now run backwards until the holder is clear of the valve, and the valve is now ready to be machined.

The last of the turning operations is cutting the valve from the shank by means of a parting tool held in the cross slide of the lathe. When this has been done, the valve shank is left in the collet. The air pressure is now turned off from the cylinder, and the pressure in front of the piston being released, the spring (CC) forces the piston to the end



COLLET CHUCK OPERATED BY COMPRESSED AIR.

the chuck may act promptly, it is well to have a reservoir of about four times the capacity of the cylinder placed in the air line as close to the controlling stop-cock as possible.

A stuffing box with graphite packing in the pressure head (F) prevents the compressed air from escaping past the pull rod. A coil spring (CC) forces the piston to the end of its stroke when the air pressure is released from the cylinder.

A chuck similar to the one described is working successfully on the turning of small four feathered valves on a turret lathe. The lathe spindle having been started up, a valve in its rough cast form (DD) is placed in a swivel-headed holder (EE) held in the lathe turret. The turret is then run up—towards the headstock—against a stop. When the shank end of the valve will have entered a set distance into the collet and pushed back the plunger (D) compressing the coil spring (E), the compressed air is

of its stroke. The collet is pushed outwards from the nose ring, and spreading out, it releases the valve shank, which is ejected by the force of the spring (E) acting on the plunger (D). The collet is now ready to receive another valve. The figure (FF) shows the valve in its finished turned form.

It was found that, as the valve was chucked on the instant, with the lathe spindle running, and on account of the extra operations which were done at one chucking, the cost of turning these valves was reduced by about 20 per cent.

While this article deals with only one form of air chuck, there are many others of different form in successful operation. Such a chuck can be used with profit on the production of machine parts in a great variety of cases, provided that the output required is large enough to justify the initial cost of the apparatus. The cost of operating one of these chucks in a factory where compressed air is already used is negligible.

IS THE AVERAGE MAN A POOR OBSERVER?

HOW many men can tell the number of spokes in a carriage wheel, or the number of spokes in an automobile? Probably they have not cared to know that as a rule there is a standard number of spokes for a carriage wheel and for an automobile wheel.

You may have a friend who daily sticks a pin in his necktie with a given number of pearls or diamonds, but if you bet him cigars, he cannot tell you the number of pearls or diamonds in it—ten to one he will lose. Detectives tell us that the color of a missing man's eyes was given by his sister as blue, by his brother as gray, while his father declared they were hazel.

Many men see a thousand horses a day in the streets and yet cannot tell without looking, on which side the mane lies, and there are hundreds of others of country birth and bringing up who have never noticed one curious difference between cows and horses. In rising after lying down, a cow always straightens her hind legs first, whereas a horse rises on his front legs to a dog-like sitting position and then jumps to his feet.

There are thousands of curious things in life that our friends the magicians and fakirs, fortune tellers and clairvoyants know and make use of, but of which the average person has no knowledge, simple because he has never observed.—Ex.

Of all fretting, that is least glorious which bewails the smallness of one's sphere, the common-place character of one's work, or the lack of recognition by one's neighbors.

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

NEW DESIGN BORING AND TURNING MILLS.

THE Niles-Bement-Pond Co., 111 Broadway, New York, have placed on the market a new design of boring and turning mills to meet the demands of manufacturing and other shops in the matter of high production with the accompaniment of ease and convenience of manipulation on the part of the operator.

By means of a centralized control, all changes of feed and reversal, rapid power traverse or hand adjustment of saddles and bars, also cross rail adjustment and table control are within reach from the operator's position. One lever disengages feed, engages fine and coarse feed, and operates fast traverse in either direction. A rapid power traverse to saddles and bars in either direction is provided. Hand adjustment of saddles and bars is by automatic releasing ratchets located at the sides of the saddles. The machine is self-contained, and as no part extends below the floor line, no special foundation is required. The housings are of box-girder form, double-webbed and broad-faced, without openings in front face. Cross-rail elevating screws are located between the housings. They are securely bolted to bed, and firmly tied together at the top by a heavy brace.

The table is deep, strongly-ribbed and supported by an annular bearing of large diameter running in a bath of oil. It is driven by coarse pitch bevel gear, accurately cut, of maximum diameter and wide face. The surface of table has four pairs of parallel and eight radial T slots. The table spindle is long and of large diameter, and is maintained in strict alignment by an upper and lower bearing. The former is bored out of the solid bed and fitted with an adjustable taper bush to take up wear. The lower bearing is bronze bushed. On the end of spindle is an adjustable threaded collar to prevent lifting.

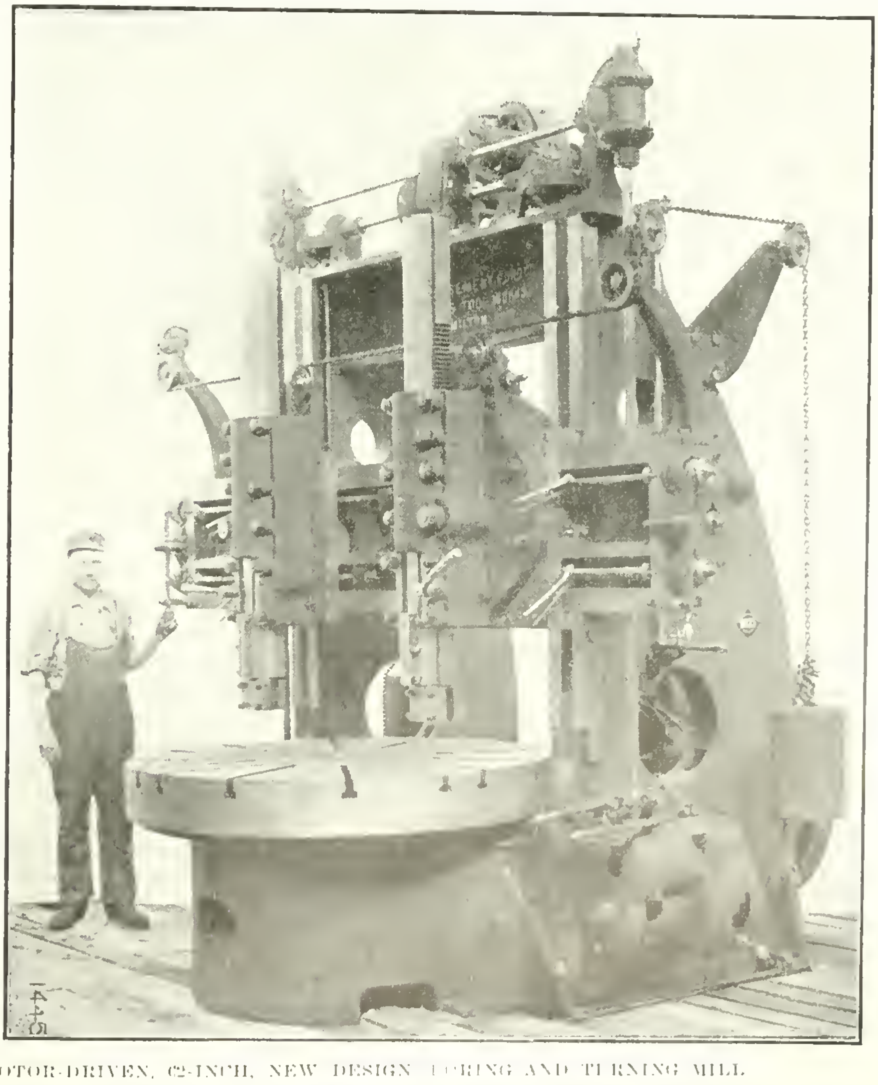
The cross rail is of the 3-track type, having narrow guide at the bottom with saddle traversing screw located between the guiding surfaces, giving an ideal condition for accurately guiding saddles. The cross-rail is box girder in form, broad-faced, and of ample depth to effectually resist heavy cutting, and may be readily clamped to the housings. Power adjustment is provided.

The saddles have wide bearings on the cross-rail, accurately scraped, with provision for taking up wear by means of taper gibs. A clamp bolt is provided for clamping each saddle when bar is feeding. Swings are accurately graduated, and swivel by means of an arc worm at the top. The bars are massive steel forgings, octagon in form, scraped to a bearing on four sides, allowing for taking up wear in all directions. Bars have continuous caps, and a binder bolt is provided in the bottom of bar cap for locking the bar when saddle is feeding.

The feeds, 8 in number, are positive, continuous and reversible, and independent for each head, both in amount and direction for down, cross and angular feeding. The tool holders are steel forgings, with provision for readily clamping tools for boring, turning and facing operations. They have straight shanks and are readily removable for the insertion of special boring bars. The counterweights for each bar are attached to the same chain, but act independently, and do not pull the swings over, nor interfere with the movement of the saddles. Counterweight chain is placed at the rear of the bars to prevent interference from overhead cranes when handling work on and off the table.

Safety friction clutches located on the vertical spline shafts insure against accidents, in case heads or bars meet with obstruction when either feeding or fast traversing. All gears are guarded.

The different materials employed throughout the machine are such as to give the best conditions for strength, rigidity and wear. All shafts are of high-grade steel, and the drive is bushed throughout with bronze. Taper gibs are used to take up wear on sliding surfaces. All driving, feeding, fast traversing and elevating gears are of very lib-



MOTOR-DRIVEN, 62-INCH, NEW DESIGN BORING AND TURNING MILL.

eral diameters, pitches and faces, and steel, bronze, raw-hide and semi-steel are used with discretion to give the best conditions of strength, and at the same time, long wear.

The motor drive by direct current is by a motor of 4 to 1 speed variation, carried on a drive plate in the rear between the housings. Power is transmitted through a double run of clutch gears, giving two mechanical changes in speed, which, with the usual 16 or more speeds in the controller, gives 32 or more speeds to the table. The motor is fitted with push-button control, and a dynamic brake for table. A separate motor, located on the top brace of the mill, is furnished for elevating the cross-rail and providing rapid power traverse to bars and saddles.

Belt drive through a single pulley or alternating current motor drive by constant speed motor is through a speed box and back gear located in the rear of the mill, giving 12 changes of speed. All gears in speed box are of Cyloid gear steel, of approximately 200,000 pounds tensile strength, treated and hardened. The speed box is fitted with a hand operated friction clutch for starting and stopping the table, while the brake provided is controlled by the same hand lever at the right hand side of the mill which operates the clutch. A separate motor, located on top brace of the mill, is furnished with A. C. drive for adjusting cross-rail, and providing rapid power traverse to bars and saddles. Belt-drive machines are built on the convertible plan, and may be readily changed to motor drive.

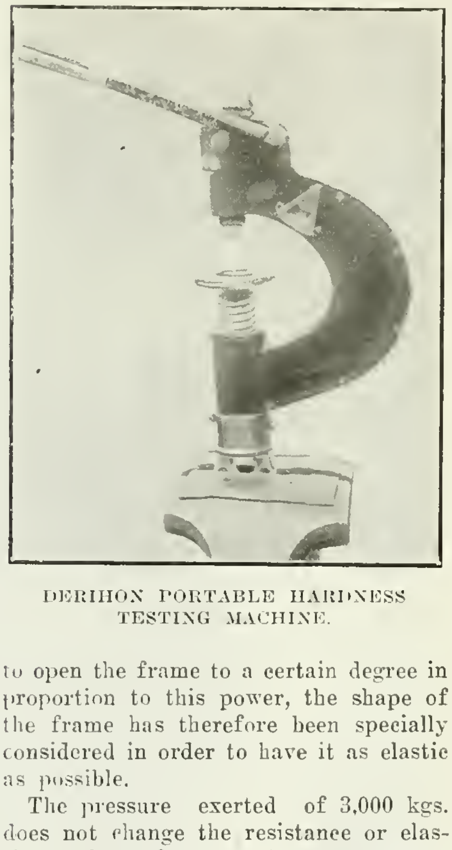
The size ratings of the different machines are 44 ins., 53 ins., 62 ins., and 73 inches; with actual swing of 44½ ins., 54 ins., 63 ins., and 74½ ins., respectively. For the foregoing sizes, the maximum height under tool holders ranges from 30 to 40 ins., the maximum height under cross rail from 36 to 46 ins., the bar travel from 20 to 30 ins., the diameter of table from 42 to 68 ins., and the horse power of motors from 7½ and 1½ to 12½ and 2.

DERIHON PORTABLE HARDNESS TESTING MACHINE.

THE purpose of the Derihon Portable Hardness Testing Machine is for testing the hardness of metals according to the Brinell method (making an impression with a 10 mm. ball under a pressure of 3,000 kgs.)

Fig. 1 shows the machine ready for the test with the lever raised and resting on the shaft. The piece to be tested is placed on the table of the machine, which is then raised until the piece is in contact with the ball. This done, the lever is pulled slowly over so as to give a progressive pressure (the pressure is registered by a small manometer), until 3,000 kgs. are applied. When this figure is reached, the lever is slowly returned to its former position and the test is completed. Under normal conditions it is usually sufficient to move the lever through an angle of 45 degrees to obtain the required pressure of 3,000 kgs. With each machine is furnished a small piece of steel in which a standard impression has been made, the size of the diameter being stamped on same. This standard piece is of BND steel, an air-hardening chrome-nickel steel. The accuracy of the machine can be easily controlled by making an impression alongside the standard impression.

The construction of the machine is based on the principle of elasticity of the frame, which for this purpose has been given the shape of a horse-shoe, as the power produced by the pressure of the ball on the test piece has a tendency



DERIHON PORTABLE HARDNESS TESTING MACHINE.

to open the frame to a certain degree in proportion to this power, the shape of the frame has therefore been specially considered in order to have it as elastic as possible.

The pressure exerted of 3,000 kgs. does not change the resistance or elasticity of the frame, and even pressures of 3,000, 4,000 or 5,000 kgs. do not work it above 10 kgs. per sq. mm. (14,423 lbs. per sq. in.). Under these conditions, repeated tests even in large numbers do not alter the calibration of the machine.

The deflection of the frame being relatively weak (1 to 1.5 mm.), a register, the construction of which resembles a metal manometer, is installed in the hollowed-out part. By means of a needle and graduated dial, the deflection and, therefore, the pressure exerted on making the test can be quickly and easily read.

To adjust the machine, it is only necessary to open the case enclosing the mechanism above the frame, and should it get out of adjustment, a comparison should be made on the standard piece. When an impression of the same diameter has been made, the needle is brought over the figure 3,000 by means of a small adjusting screw. This adjustment, however, should, it is claimed, only be necessary through some accidental cause independent of the operation under normal usage.

The machine is being placed on the market by H. A. Elliott, 507 Majestic Bldg., Detroit, Mich., and is furnished in a neat portable case.

PUMPING PLANT NUISANCE.

"INASMUCH as the pumping of water is necessary for municipal purposes, the case, I think falls under the Judicature Act, empowering me to refrain from granting an injunction and to substitute damages."

Thus, has Mr. Justice Middleton given judgment at Osgoode Hall against the City of Toronto in favor of Vaux Chadwick and Jessie D. Chadwick, Poplar Plains property owners, who sued for $5,000 damages and an injunction restraining the city from operating certain electric pumps at their high level pumping station.

Mr. Justice Middleton directs that the damages be assessed by the Master-in-Ordinary, unless the parties agree upon another referee and suggests that if the evidence be taken before him, he will assess the damages himself.

The eight electric pumps in question were installed in 1912 and, instead of the comparatively slow motion of the reciprocating steam pumping engine they operate at a speed from 721 to 750 revolutions per minute. The result is a sensible vibration and a continuous humming noise, which varies in intensity on account of the pumps not being run in unison and at a uniform speed.

The city has done much to minimize the noise and vibration and the condition to-day is nothing like as serious as it was before a new and different diffusion ring was substituted to the pumps. A nuisance still exists, however, and it is held that the adverse conditions are more likely to be increased by the addition of more pumps to the plant than lessened by any further improvements or changes to the pumps.

The decision of this case establishes precedent, and it is expected that others in the neighborhood will now institute actions to secure similar damages for the depreciation of value of their property.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Attention is drawn to the alternating course in arithmetic, a concurrent study of which is recommended with that of the Question and Answer Series.

Question.—A steam boiler 16 feet long and 40 inches in diameter, is made of material ½ inch thick, and carries a pressure of 80 pounds per square inch gauge. What is the stress in the shell-plate?

Answer.—The total pressure tending to disrupt the shell would be the total pressure on the longitudinal cross section, which is $16 \times 12 \times 40 \times 80 = 614400$ pounds.

This pressure is distributed over twice the cross sectional area of the plate, or a surface equal to $16 \times 12 \times 2 \times \frac{1}{2} = 192$ square inches. Stress in shell plate is, therefore, $\frac{614400}{192} = 3{,}200$ lbs. per sq. in.

* * *

Question.—What width of double-ply leather belt would be required to transmit 176 horse-power from a 7-foot pulley at 96 r.p.m.?

Answer—Using formula $w = \frac{H.P. \times 300}{V}$

In which
w = width of belt in inches.
H.P. = horse-power transmitted.
V = velocity of belt in feet per min.
300 = a constant for double belts.
V = circumference of pulley × r.p.m.
or

$$V = \frac{22}{7} \times 7 \times 96 = 2112 \text{ ft. per min.}$$

Then $w = \frac{176 \times 300}{2112} = 25$ inches, or say a 26-inch belt.

* * *

Question.—A motor running at a speed of 600 r.p.m., drives a fan through a counter shaft. A 10 in. pulley on the motor drives to a 28 in. pulley on the countershaft which, in turn drives a 12 in. pulley on the fan from a 56 in. pulley. Find the speed of the fan.

Answer.—Drivers are 10 in. and 56 in.
Driven are 28 in. and 12 in.

Speed of fan, therefore, is

$$\frac{10}{28} \times \frac{56}{12} \times 600 = 1000 \text{ r.p.m.}$$

* * *

Question.—What should be the thickness of a 10 in. cast iron water pipe to carry a steady pressure of 300 pounds per sq. in.

Answer.—Using a factor of safety of 6, the working stress would be $\frac{20{,}000}{6}$

Pressure tending to disrupt pipe is $\frac{10 \times 300}{2} = 1500$ pounds.

Area of metal necessary to resist this is $\frac{1500}{20000} \times 6 = .45$ sq. in.

As we are considering a section 1 in. long, the required thickness would therefore be .45 inch.

* * *

Question.—What horse-power boiler would be required for a good Corliss engine of 120 h.p. taking steam at 100 lbs. gauge and with feed water at 200 degs. Fah?

Answer.—An engine of this type would use about 20 pounds of steam per horse-power hour.

One boiler horse-power represents the evaporation of 34.5 pounds of water from and at 212 degs., and to reduce the above conditions to this base the factor of evaporation is used, which for this pressure and feed water temperature is 1.052.

Steam used per hour is $120 \times 20 = 2400$ pounds.

Boiler h.p. required is

$$\frac{2400 \times 1.052}{34.5} = 73.18 \text{ h.p.}$$

* * *

Question.—What would be the weight of water in a cylindrical tank three-quarters filled and of the following dimensions, diameter 20 ft., and height 14 feet.

Answer.—Find volume of ¾ of tank thus:

$$\text{Volume} = \frac{3}{4} \times \frac{22}{7} \times 10^2 \times 14 = 3300 \text{ cub. feet.}$$

$$\text{Weight} = 3300 \times 62.5 = 206{,}250 \text{ lbs.}$$

$$\text{or } \frac{206{,}250}{2000} = 103\tfrac{1}{4} \text{ tons.}$$

* * *

Question. — What would be the required diameter of a mild steel piston rod for an engine 24×30 with a maximum steam pressure of 90 pounds per square inch?

Answer.—Maximum load on piston would be area × pressure or,

$$\frac{12^2 \times 22 \times 90}{7} = 40715.1 \text{ pounds.}$$

Allowable working stress is 8,000 pounds per square inch under these conditions.

Area required then is

$$\frac{40715.1}{8000} = 5.0893 \text{ square inches.}$$

Diameter of a shaft of this cross sectional area would be $2\sqrt{a \times \frac{7}{22}} = 2.54$ inches or approximately 2½ inches.

* * *

Question.—Why is it necessary to make the longitudinal seams of a boiler shell twice as strong as the circular seams?

Answer.—Consider a shell 10 inches in diameter sustaining a pressure of 100 pounds per square inch.

Stress on lengthwise seam per inch of length $= \frac{10 \times 100}{20}$ or 500 pounds.

Stress on 1 inch of ring seam is equal to total pressure on shell cross section divided by the length of the seam, or is equal to

$$\frac{3.1416 \times 5^2 \times 100}{10 \times 3.1416} = 250 \text{ pounds.}$$

Which is half that for the longitudinal seam.

* * *

Question.—What would be the approximate mean effective pressure throughout the stroke of a noncondensing engine, the steam pressure being 120 lbs. gauge, the back pressure being 17 lbs (absolute), and the point of real cut off at 1-6 of the stroke.

Answer.—Using formula $\text{M.E.P.} = \frac{.9P(1 + 2.3 \log. r)}{r} - .9p$

In which P = steam pressure absolute = gauge pressure + 14.7 lbs.
r = ratio of expansion.
p = back pressure absolute.
.9 = indicator factor depending on quality type of the engine.

We get

$$\frac{.9 \times 134.7 \times (1 + 2.3 \times .77815)}{6} - .9 \times 17 = \frac{121.23 \times 2.789}{6} - 15.3 = 41.05 \text{ pounds per sq. in.}$$

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Vol. XI. APRIL 16, 1914 No. 16

PRINCIPAL CONTENTS.

APPRENTICE INSTRUCTION.

THE dividend-paying capacity of apprentices depends very largely upon the speed with which they absorb a working knowledge of their chosen occupation. The great object of an apprentice system, viz., providing efficient future mechanics for the trade, is only accomplished in proportion to the success achieved in making the apprentice an earning unit from the start.

Many attempts have been made, particularly by the larger institutions, to accomplish this desired end and the means adopted have varied widely. These in most cases consist of series of lectures usually given by the chief draughtsman or master mechanic during time for which the apprentice is paid. The drawbacks to such systems are many. The lectures interfere more or less with the shop work; they rarely pertain directly to the shop problem occupying the young mechanic's mind at the time, and the lecturer in several cases that have come under our observation, has never been an apprentice himself.

In an association with seven shops employing from ten to thirty apprentices, covering a period of two years, the writer found but one where full and reliable information could be obtained by any apprentice upon such work as he had in hand. In the majority of these plants, the seeker was forced to depend for information upon his senior associates, and upon journeymen whose grace in giving it was often questionable. The logical solution is to appoint an efficient and well paid apprentice instructor of such character as can be emulated with advantage, where the number of apprentices warrants it. If the number be small, this man can well earn his salary by acting as apprentice foreman in addition.

The youth with sufficient ambition to make a desirable mechanic and an earning asset to the firm while training, is always willing to go to night school for his drawing lessons as well as to get his requisite technical knowledge from books if directed in his reading by one whom he can thoroughly respect as having both his and his employer's interests at heart.

VALUE OF A MONTH'S HOLIDAY.

OF late it has been our regretful duty to record the deaths of a number of men filling high and very useful positions in the industrial community. In some cases the end was doubtless brought about more or less directly by overwork and too close and insistent application to very distracting and maybe somewhat thankless tasks. The difficulties experienced in replacing these men have also been called to our attention.

The maintaining of efficient and capable understudies in such a way as to relieve the extremely important men of more or less of the clerical, laborious and disagreeable parts of their work and, at the same time, provide men to supplant them constitutes a vital and vexing problem in connection with the management of all great commercial industrial institutions.

The actual value of a higher official is a quantity that is extremely difficult to estimate as the output or apparent success of the plant is influenced by a great many facts not under his control or chargeable to him. In other words, a great part of his hardest work may be very valuable, but it is still decidedly intangible.

The practice of granting a month's vacation can, by no means, be regarded as a gift to its evident beneficiary, although, if properly taken advantage of by him, it can be made a profitable investment for the firm. This relaxation period should be regarded as a necessary opportunity for testing the fitness of assistants and understudies in a way that is impossible when the official in question is on the job. A close observation of the running of the department or plant during his absence will also furnish the most reliable data as to his real value. It is a most opportune time to plan and develop promotion schemes, for, not only can the worth of the man on vacation be determined, but a suitable man can most easily be spotted to succeed him.

INDUSTRIAL NOTABILITIES--No. 30

THE subject of this biography, Edward Gurney, was born August 4, 1845, at Hamilton, Ont. His father was Edward Gurney, an iron founder, and his mother, Nancy Flarity. Mr. Edward Gurney, the father, was of English descent, and born in New York State, while his mother was of Irish descent, and also a native of New York.

Edward Gurney was educated at the public schools, also at the Hamilton High School. After completing his studies, he engaged with the firm of E. & C. Gurney, learning the trade of moulder, and later entering the firm's employ as clerk. This was in 1863.

In 1868 the Gurney Company bought out the Phoenix Foundry Co. of Toronto, which was carried on as a branch of E. & C. Gurney, with Mr. Edward Gurney as manager. The firm afterward moved to its present quarters on King Street in 1873. In 1893, it was merged into the Gurney Foundry Co., of which Mr. Gurney became president, a position which he still holds.

EDWARD GURNEY.

Mr. Gurney is president of the following Companies: The Gurney Foundry, the Gurney-Massey, of Montreal, and the Gurney Heater Mfg., of Boston. He is also vice-president of the Gurney North-West Foundry Co., of Winnipeg, vice-president of the North American Life Assurance Co., of Canada, and a member of the Toronto, National and Automobile Clubs.

Mr. Gurney married Mary Frances Cromwell of Ingersoll, Ont., daughter of William A. Cromwell, January 2, 1868. They are the parents of the following children: Mary Irene, wife of W. Sandford Evans, Mayor of Winnipeg; Mabel Louise, wife of E. B. Ryckman, of Toronto; William Cromwell Gurney, vice-president of the Gurney Foundry Co.; Edward Holt Gurney, sales manager of the Gurney Foundry Co., and Gladys Gurney, unmarried.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, f.o.b., Pittsburgh	.....	$13 90
Lake Superior, charcoal, f.o.b., Chicago	.....	16 00
Middlesboro, No. 3	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron	[illegible]	
Ferro Nickel pig iron (Soo)	.....	25 00
Victoria, No. 1	19 00	18 35
Victoria, No. 2X	18 75	18 10
Victoria No. 2 Plain	18 50	17 85

BILLETS.

	Per Gross Ton.
Bessemer billets, Pittsburgh	$20 00
Open hearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	24 00
Wire rods, Pittsburgh	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.00
Steel bars, f.o.b., Toronto	2.05
Common bar iron, f.o.b., Montreal	2.05
Steel bars, f.o.b., Montreal	2.05
Bessemer rails, heavy, at mill	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAIL AND SPIKES.

Standard steel wire nails, base		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails		75 per cent.
Pressed spikes, 5/8 diam., 100 lbs.		2 85

BOILER PLATES.

	Montreal.	Toronto.
Plates, 1/2 in. 100 lbs.	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1 1/4 in.	9 50	9 00
" " 1 1/2 "	9 50	9 00
" " 1 3/4 "	9 50	9 00
" " 2 "	8 75	8 75
" " 2 1/2 "	11 15	11 50
" " 3 "	12 10	12 50
" " 3 1/2 "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7 1/2
Coach and lag screws	75
Plate Washers	45
Machine bolts, 3/8 and less	65 & 10
Machine bolts, 7-16	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4 1/4 per lb off
Nuts, Hexagon, all sizes	4 1/2 per lb off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright	85, 10, 7 1/2, 10, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7 1/2, 10 p.c. off
Wood screws, flathead, bronze	70, 10, 7 1/2, 10 p.c. off

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in.	75%
Finished Nuts over 1 in.	72%
Semi-Fin. Nuts up to 1 in.	72%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, uncr'bled, heavy	11 50	11 50
Copper wire, uncrc'bled.	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 comps'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machinery cast iron	12 00	12.00
New brass clippings	8 50	8 75
No. 1 brass turnings	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
1/8 in	$ .05 1/2	1/8 in	$ .12	1/2	$. 32
1/4 in	.06	1/4 in	.07 1/2	3/4	.35
3/8 in	.06	3/8 in	.07 1/2	1	.37
1/2 in	.08 1/2	1/2 in	.11	1 1/4	.52 1/2
3/4 in	.11 1/2	3/4 in	.15	1 1/2	.65
1 in	.17 1/2	1 in	.22	2	.91
1 1/4 in	.23 1/2	1 1/2 in	.30	2 1/2	1.37
1 1/2 in	.27 1/2	1 1/2 in	.36 1/2	3	1.86
2 in	.37	2 in	.50 1/2	3 1/2	2.30
2 1/2 in	.58 1/2	2 1/2 in	.77	4	2.76
3 in	.76 1/2	3 in	1.03	4 1/2	3.26
3 1/2 in	.92	3 1/2 in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4 1/2 in	1.27	4 1/2 in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	.....	...	.....
10 in	3.50	....	.....	.....	.....
10 in	4.12	....	.....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
1/4, 3/8 in.	64	49	....	....
1/2 in.	69	58	....	....
3/4 to 2 in.	73 1/2	63 1/2	....	....
2 in.	....	....	69 1/2	59 1/2
2 1/2 to 4 in.	73	63	72	62
4 1/2 to 6 in.	....	....	73	63
7, 8, 10 in.	....	....	67 1/2	56 1/2
X Strong P. E.				
1/4, 3/8 in	56 1/2	46 1/2	....	....
1/2 in.	64	54	....	....
3/4 to 1 1/2 in.	68	58	....	....
2 to 3 in.	69	59	....	....
2 1/2 to 4 in.	....	....	66	56
4 1/2 to 6 in.	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
1/2 to 2 in.	43	33	....	....
2 1/2 to 4 in.	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload	$15 75	$15 75
Electrolytic copper	15 50	15 25
Casting copper	15 00	15 00
Spelter	5 25	5 25
Tin	40 00	41 00
Lead	4 85	5 30
Antimony	8 50	8 50
Aluminum	21 00	19 00

SHEETS.

	Montreal.	Toronto.
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4.30	4.10
Queen's Head, 28 B.W.G.	4.40	4.20
Fleur-de-Lis, B.W.G.	4.20	4.20
Gorbal's Best, No. 28	4.40	4.40
Viking metal, No. 28	4.20	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal	0.22
Pure turpentine	0.69
Linseed oil, raw	0.60
Linseed oil, boiled	0.63
Plaster of Paris, per bbl	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., April 13, 1914.—The Easter holidays interrupted business during the past week, and there is little to report. Machinery dealers still find conditions quiet. Mussen's, Ltd., closed an order of about $1,500 last week for machine tools ordered by the Alberta Government. This firm have also sold a 12½-ton Ruston & Proctor road roller to the Corporation of Knowlton, Que.

The C.P.R. issued a specification for three or four small machine tools for North Bay recently, and a decision in this matter is looked for this week. The same company are also about to place orders for the tools still required for the new steel car shop here, a list of which was recently published in Canadian Machinery.

The Government's tariff alterations have caused little local comment so far. No change in prices due to the new tariff have yet been announced, and it seems unlikely that much advance need be looked for in most lines of steel products. An exception may, however, be made in the case of wire nails, since a duty is to be imposed on wire rods, which have hitherto come in free. Speaking generally, the steel industry ought to materially benefit by the proposed changes. A press despatch received today from Sault Ste. Marie, Ont., credits Mr. J. Frater Taylor, president of the Lake Superior Corporation, with saying that the protection to be afforded to structural shapes of over 35 lbs. per yard will enable the Algoma Steel Corporation to at once go ahead with its plans for the installation of a heavy structural rolling mill of large output. This important step is understood to have been in contemplation for some considerable time.

Good progress is being made with the completion of the Canadian Northern tunnel through Mount Royal. The work of enlarging the preliminary bore is well advanced, and should be entirely finished by the end of May. A commencement has been made with the excavation for the station terminal below Dorchester Street.

The C.P.R. are about to spend a very large sum in four-tracking their line between Windsor Street station and Montreal Junction, a distance of four miles. This will mean the putting down of two additional tracks, and will entail a large amount of filling in, building of viaducts and the widening of two bridges. The total cost is estimated at $1,000,000.

The recent spell of cold weather has greatly retarded the break-up of the ice on the St. Lawrence, and it now looks as if the opening of navigation would be considerably later than usual this year. A few weeks ago wise-acres were giving April 15 as the probable date, but it now appears unlikely that any steamer can enter Montreal harbor before the end of this month. At present writing an almost solid stretch of ice extends nearly down to Three Rivers, and is said to be from one to four feet thick.

Toronto, Ont., April 14, 1914.—No improvement in trade conditions is noticeable this week. The market all round is dull, and seems likely to remain so for some time. It is perhaps rather early to form an opinion as to the effect of the recent reduction in railway rates. The railway companies naturally complain and state that they are being treated unfairly. The situation will no doubt, however, work out for the benefit of the country in general. The reduction in the duty on certain steel products has called forth a variety of opinion, both favorable and otherwise, according to the effect that it will have on the interests concerned. One good feature to be noted is the beneficial effect being produced in the wire rod industry, which had been languishing in recent years. Concerns fabricating structural steel appear to think that an unfavorable effect will be produced on this industry, but the reduction is so slight that it seems hardly probable that they will suffer to any great extent.

An examination of the building permits issued for the first three months of this year shows a slight decrease over the corresponding period of last year for this district, although in some cities an increase is to be noted. The reduction in the price of materials has to some extent offset the effect produced by the financial stringency, although the latter is still holding up large building propositions which require considerable financing. Work on the Toronto harbor improvements will be pushed ahead this year, it being reported that $3,000,000 has been appropriated for this season's work.

No change is to be noted in the steel market. The volume of business is light and prices generally remain stationary, although there is an indication that they may be reduced in the near future, unless an improvement in conditions takes place. Reports from Pittsburg indicate that conditions are becoming quieter and tonnage lighter. An unfavorable feature is the possibility of a reduction of wages in that district. The United States Steel Corporation tonnage of unfilled orders for March showed a shrinkage of 300,000 tons. No new large buildings requiring structural steel are in evidence in Toronto, but some of those now projected may be proceeded with later in the year.

The pig iron market is distinctly dull. The change in prices given last week was on account of the opening of navigation and affected only English and Scotch pig. For other brands prices remain at the same level.

The machine tool market is quiet, with few inquiries, and those only to small specifications. The holiday season appears to have had some effect on this market. Steady business is reported in mill supplies, orders being for immediate requirements only. One local firm of dealers reports having sold a Bignall & Keeler pipe-threading machine.

The general condition of the metal market is dull, with prices inclined to weaken, except copper, which remains

firm. The volume of trade is still light, but merchants are of the opinion that business will steadily improve.

Ottawa, Ont., April 13, 1914.—Between the budget announcements and the western freight rate judgment of the Railway Commission the politicians as well as the business world have been given something to think over during the Easter holidays. The budget announcement has at least had this effect: that it has removed the uncertainty, and nothing is so unsettling to the commercial realm as uncertainty. The budget was a compromise, as most budgets are between the two extremes. The westerners wanted a big slash in agricultural implements. They got some, but not all they wanted. There is a decrease from 17½ to 12½ per cent. on binders, mowers and reapers. Other agricultural implements are untouched.

The steel and iron industry has been making a big lobby for aid. They got substantial assistance, but not all they wanted. The aid takes several forms. The principal changes are an increase in the duty on heavy structural iron to $4.25, $6 and $7 per ton. This will not be put into effect until the Government is satisfied that it can be manufactured in substantial quantities in Canada. That this will give a boom to the manufacture of such lines is undoubted. The total iron and steel and manufactured products imported into Canada last year showed an increase on the year previous of a little under forty million dollars. Of course, this trade is far from being affected.

The Government has also put a duty on wire rods, which were imported last year to the extent of 92,000 tons. The duty has been placed at $2.25, $3 and $3.50. Just how this will affect the small nail manufacturers it is hard to say. They opposed the duty strenuously. At present they buy large quantities of wire rods from Germany and the United States. Now they will be forced to purchase from their own competitors in the nail business, the Dominion Iron and Steel Co., and the Steel Co. of Canada. On the surface at least it looks as if the small manufacturers will be seriously handicapped. The big steel corporations will undoubtedly be able to make nails in their own factories with their own steel products cheaper than firms which must purchase the raw product from them and pay freight to their mills. Mr. White pointed out, however, that if it did work a hardship they had the right to appeal, and the Customs board could again put steel rods on the free list. These are the two main forms of assistance, though Ontario mills must be substantially benefited by the drawback on charcoal and coke used for smelting purposes. To the Nova Scotia corporations having their own coal at hand it makes no difference, but to the Ontario mills buying all coal products in the States this is a concession of importance. How important it is difficult to say. The main other changes are a 10 per cent. duty on brass in sheets and rods. Just how important an item is this is shown by the fact that the imports last year totaled nearly a million dollars. A new firm in West Toronto is at present manufacturing this material. How this will affect manufacturers of machinery remains to be seen. These are the main changes which interest the machinery world.

The western freight rates decision would take an expert to thoroughly analyze, and what is its complete significance will not likely be known until the new rates are put into effect on September 1. One railway authority puts the reductions which have been made at some three million dollars. This is perhaps a little high. Through rates are not affected, although eastern shippers will benefit by the western reductions. The discrimination in rates, which was the original complaint and charge, are permitted and allowed to continue. The board throws aside this charge and deals with the whole question from the standpoint of reasonableness. The result has been a complete readjustment of western rates. Hitherto the standard rate in Manitoba has been 7½ per cent. lower than Saskatchewan and Alberta. Now the three provinces are placed on the same basis. This means a straight reduction for the two other provinces of 7½ per cent. There is also a lowering of distributing tariffs. Winnipeg distributing tariff is lowered by about 7 per cent. and all other western distributing centres are placed on the same basis.

Then, in addition, there are important class reductions. One of the most important reductions, and one which has been rather overlooked in press despatches, is the reduction on pig iron rates from the head of the lakes to Winnipeg. The rate is now 20 cents per 100 pounds. This is reduced to $3 per gross ton, or a cut of 25 per cent. Winnipeg has already three growing rolling mills. The reduction should give a big impetus to this industry and help to make Winnipeg, with its cheap water power, one of the most important steel and iron centres in Canada. It will likely ultimately help all industries into which iron and steel enter.

Winnipeg, Man., April 11, 1914.—Brokers here understand that the order for machine tools required in the G.T.P. shops, at Prince Rupert, B.C., will be placed in a few days by J. H. Guess, in Montreal. Many local houses have figured on the requirements.

There is considerable demand just now for heating boilers for school buildings, warehouses, etc., which are going up in Winnipeg. Orders for machine tools are coming in fairly well. The Canadian Fairbanks-Morse Co. report this to be the best month they have had since January. They have sent out quite a number of tools during the week, principally to small machine shops and garages. The Regina School Board have placed an order for two metal and wood lathes for use in their technical schools.

The Winnipeg School Board are in the market for a large quantity of machine shop supplies, including tool steel, nuts, washers, bolts, gears, etc., for use in the Kelvin and St. John's Technical Schools. The order altogether will amount to several thousand dollars. A local broker stated this week that Canadian manufacturers of machine tools should have a better chance of securing the technical school business since the duty was enforced on machine tools imported for use in schools.

In the West the budget speech of Hon. Mr. White was received by bridge and iron plant managers with regret. Much of the structural steel used by the large manufacturers is imported from the United States, and the increased duty on large sizes will be particularly felt here. Mayor Deacon, who is president of the Manitoba Bridge and Iron Works, says he will object to the reduction of duty on fabricated iron and steel. The Americans, he says, with low freight rates and cheap labor, will be able to bring their products in here at greatly reduced rates, to the loss of western bridge companies.

Another large western iron and steel manufacturer, speaking on this subject, expressed the belief that the new tariff would injure the United States Steel Corporation, and would be another inducement for them to establish their plant at Windsor. He also stated that British manufacturers would benefit considerably from the changes. One firm that should profit by the changes in the duty on iron pipe is the Page-Hersey Co., who recently erected a large plant at Fort William to supply the trade in Western Canada.

Building permits issued in Winnipeg up to date considerably exceed the three-million-dollar mark, which is in excess of last year. There are many who believe that not 10 per cent. of these buildings will be commenced this year, while there are others who pooh-pooh this idea. They believe that building will be up to standard, but will consist mostly of small structures rather than the large blocks that have gone up in the past few years. The manager of a large western industry, who has just returned from a study of conditions further West, states that the

amount of building out there will exceed that of last year, but will be late in starting. Builders, he says, will be obliged to figure much closer than in former years.

The manager of a large engineering plant in Winnipeg says that he does not intend to spend money this year on new equipment, adding that his business was quieter now than it ever was in 1913. He has kept his plant running all through the winter, employing about 300 men, running ten hours a day, but has accumulated considerable stock. He thought the warmer weather would put new life into business. Speaking of the large number of building permits issued, he observed that this was the best time to build, as both labor and building material were cheaper.

St. John, N.B., April 11, 1914.—According to a cable received from J. Norton Griffiths, M.P., head of the contracting firm having the development work at Courtenay Bay, St. John, in hand, three new dredges are on their way here, besides steam hoppers, to advance that big project, involving an expenditure of more than $12,500,000. The dredges are due to arrive early next week. Seven hundred pieces of machinery were landed here this week by the company, consisting of buckets, dredging equipment, and other apparatus for use in the extensive operations to be pushed forward this year.

F. H. Anson, managing director of the Atlantic Sugar Refinery Co., Montreal, in the city this week, said good progress had been made on the plant, and he expected to have it ready for refining operations this year.

The possibility of another new industry for St. John was considered today at a conference between C. H. Cahan, jun., of Montreal, and Herbert Guernsey, of this city. The proposition is the organization of a company for the manufacture of silicate brick. Mr. Cahan is interested in the Canada Brick Co., and the Silicate Engineering Co., Ltd., of Montreal, both manufacturers of Dominion and Canada bricks. The proposed site for the new industry is at Ketepec.

The machinery has arrived at Gibson, N.B., for the plant of the Concrete Builders, Ltd., who will manufacture marble-faced, pressed blocks, ornamental cornices, pressed bricks, water pipes, tile pipes and concrete blocks. The gravel necessary will be dredged from the Nashwaak River. The company elected officers yesterday as follows:—T. C. Burpee, president; J. J. McCaffrey, secretary and treasurer; H. J. McGrath, manager. The officers, with A. J. Gregory and Hon. J. P. Burchill, constitute the directorate; while others in the company are Albert Kitchen, Ray Burpee, and Hon. H. R. Emerson.

C. A. Wentworth, provincial manager for Foundations, Ltd., who was in the city yesterday, said that the company was making encouraging progress upon its contracts in New Brunswick. The new bridge which they were building across the Miramichi River at Newcastle, is nearing completion, and the five abutments for the steel work are now about finished. This contract involved an outlay of $375,000, and several large coffer dams had to be built. The company's work on the new bridge across the Washademoak Lake for the N. B. Coal and Railway Co. was finished this week.

SOO PRESIDENT LIKES TARIFF CHANGES.

MR. J. FRATER TAYLOR, president of the Lake Superior Corporation, gave out the following statement a few days ago, regarding the increase in the iron and steel duties:

"I have waited for a full report on the tariff changes before expressing an opinion. I am very much pleased that the Government has recognized the serious necessity for assistance to the steel industry in Canada. Speaking generally the changes are in the right direction and will benefit the industry as a whole; but in our specific case, that is, the case of the Algoma Steel Corporation, the promise of definite assistance in the manufacture of the larger sizes of structural steel is a decisive step forward, and will enable the Algoma Steel Corporation to immediately progress with its plans for the installation of a heavy structural mill of large capacity. This has been contemplated for some time, and now that protection is afforded in respect of rolled sections over 35 pounds, there is some incentive to our taking the necessary steps to mature our plans and to arrange our finances. Nothing definite has been done in the matter of encouraging the mining of iron ore, but an investigation is promised, and it is hoped that this will bear fruit."

STEEL CO. OF CANADA REPORT FOR YEAR.

THE pamphlet report of the Steel Co. of Canada for 1913 shows net profits after expending $516,084 for repairs, maintenance, and improvement, of $1,640,011, which compares with net profits of $1,547,039 at the end of 1912, an increase of about $93,000.

Of this amount $480,000 was taken by bond interest, $454,741 by dividends on the preferred stock, $137,500 was credited to the fund for depreciation, renewal and improvement of plants, $56,738 was written off plant account, and $511,681 was carried to credit of profit and loss. The report states that since Dec. 31, the directors have disposed of $850,000 of the first mortgage bonds of the company, and the working capital has been increased by the proceeds of that issue.

The president's report states that during the first half of 1913 the business of the company was active and profitable, but during the last half of the year there was a serious falling off in the volume of business and in prices.

The president says, with reference to the recently announced tariff changes, that "it is thought that these changes will be beneficial to the company."

	1912.	1913.
Brought forward	$ 583,599	$1,060,571
Net profits	1,547,039	1,640,000
	$2,130,638	$2,700,581
Less–		
Bond interest	465,327	480,000
Pref. dividends	454,741	454,741
Depreciation	150,000	137,500
Written off	...	56,738
Balance	$1,060,571	$1,571,602

The general balance sheet shows that current liabilities, consisting of accounts and bills payable and dividend due February 1 have been reduced from $4,018,926 at the end of 1912 to $3,069,449 at the end of 1913, a decrease of $949,477; but, on the other hand, a new item of $1,200,000, convertible promissory notes, due July 1, 1915, 16 and 17, appears in the liabilities.

Current assets, consisting of material, cash on hand, etc., show a decrease of $305,823, the figures being, 1912, $8,007,889; 1913, $7,702,066.

The annual meeting is called for Monday, April 27.

STEEL CORPORATION OUTPUT.

THE production of the Dominion Steel Corporation for the fiscal year ending March 31, shows some curious changes. There is a very large falling off in the production of wire rods and an increase in wire products. Shipments were less. The statement compares with the previous year as follows:

	1914 Tons.	1913. Tons	Increase or Decrease Tons.
Coal	5,026,645	5,053,160	26,515
Ore received	810,821	704,542	+ 106,279
Pig iron	334,101	321,020	+ 13,081
Steel ingots	331,349	343,251	11,902
Rails	176,505	171,802	1,703
Wire rods	30,778	53,323	– 22,545
Bars	16,736	451	+ 16,285
Wire products, etc	32,111	10,962	+ 13,352
Shipments	246,250	287,591	— 41,341

A "Safety First" campaign is being inaugurated by Superintendent Gaboury, of the Montreal Tramways Co. Letters containing suggestions have been mailed to all employees, chauffeurs and hack drivers throughout the city.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Wiarton, Ont.—The Peninsular Tug & Towing Co. has opened a machine shop here.

Redcliff, Alta.—It is reported that the Ornamental Iron Works Co. will enlarge their plant.

Peterborough, Ont.—The board of works will probably purchase a boiler for use in thawing drains and hydrants.

Welland, Ont.—The Supreme Heating Co., stove manufacturers, are increasing their capital and will make an addition to the plant.

Ingersoll, Ont.— Operations will be commenced at the Wilson & Short factory at an early date. Most of the machinery has been installed.

Winnipeg, Man.— An automobile assembling plant, employing about 500 people, will probably be built in Winnipeg or just outside the city by the Ford Motor Co., of Detroit, Mich., very shortly.

Kelowna, B.C. — Messrs. DuCane & Dutcher, engineers of Vancouver, have reported in favor of an extension to the existing municipal power plant, and the addition of a boiler, steam engine and auxiliaries.

Sarnia, Ont. — The new Perfection Stove Co. plant in the south end of the town will soon be ready for operation. Carpenters are at work laying the floors in the main building, and the machinery will be installed very shortly.

Wallaceburg, Ont.—The Wallaceburg Electric Light Co. has at last accepted the city's offer of $30,000 for the plant, after holding out for some time in the hope of getting an additional $5,000. A by-law will be prepared shortly to let the people decide the matter.

Fort Erie, Ont. — The International Register Co., has been incorporated with a capital of $100,000. The company will build a factory here for making small safes, registers, etc. Mr. S. A. Waugh is president of the company.

Saskatoon, Sask.—The premises of the John East Foundry Co., were partly destroyed by fire on April 10. The fire was confined largely to the pattern shop where the most damage was done, the loss being estimated at between $7,000 and $8,000 covered by insurance. Rebuilding will be commenced at once.

Regina, Sask.—Wilson & Wilson have been awarded the contract for the completion of the new power house, the contract price being $90,800, and it is understood that work will be commenced at once. The steel work is already up and the new contract will cover the brick work, concrete roof, interior finishings, etc. An effort will be made to complete all work before the Fall.

Nanaimo, B.C.—The Dominion Shale & Brick Co., whose works are situated on Gabriola Island, are getting ready to cope with the coming season's business, which is already showing increasing signs of activity. They are at present busy installing their own electric light plant. A "Klose" kiln is also being installed.

Collingwood, Ont. — The scrutiny of the ballots in connection with the recent voting on the Imperial Steel and Wire Works by-law has been completed, and while the written judgment will not be handed down for a few days, it is understood that the by-law received the 36 votes over the two-thirds requirements, or 888 to 629. The by-law guarantees the bonds of the company to the extent of $100,000.

Galt, Ont.—Engineers from the Dominion Public Works Department in Freeport have been making surveys and taking levels in connection with the proposed erection of several large dams across the Grand River for conservation and regulation of the water, with the object of abating spring freshet damages and securing a more regular flow in summer months. It is not unlikely that a large dam will be built at Freeport.

Electrical

Swift Current, Sask. — The city will purchase a site for a light and power plant.

Embro, Ont.—A public meeting of the ratepayers has been called for Thursday evening, April 16, to discuss the hydro electric proposals. It is expected that estimates will be secured shortly.

Woodbridge, Ont.—By a large majority on Saturday the ratepayers decided at the polls to enlist under the Hydro banner and enjoy the advantages of cheap power. The by-law was carried by a vote of 96 to 4.

Brantford, Ont.—At a recent meeting of the water commissioners it was decided to ask for tenders for the new electric pumps and the new extension to the pump house.

Nelson, B.C.—To reduce operating expenses at the gas plant the city council on the advice of the superintendent has decided to order an electric motor exhauster to replace the steam exhauster at present in use.

Sidney, N.S.—It is stated that the Dominion Steel Corporation will shortly begin to operate their wire rod mills on full time. For the last three years they have not been working more than three days a week.

Halifax, N.S.—The Provincial Government have appointed a special committee to inquire into the necessity of periodical boiler inspection in all factories and plants. It is generally believed that a bill be drafted and introduced in the Legislature.

St. Catharines, Ont.—At a meeting of the Niagara district Hydro Radial Union held recently, it was decided to ask the various municipalities in Lincoln, Welland, Haldimand and East Wentworth to petition the Hydro Commission to make a survey for a proposed radial line through the peninsula.

St. George, Ont. — One hundred and twelve residents of South Dumfries have petitioned for hydro-electric service. This list includes only a few in St. George, the majority being farmers representing every section in the township east of the river. The petition has been forwarded to the commission and their engineer will investigate and report.

Wingham, Ont.—The Culross township council have passed a motion that this municipality join with other municipalities in the district in membership in the North-Western Ontario Hydro Association for the purpose of laying before the Ontario Hydro Commission their position with the object of urging their right to share in the advantages bestowed on other places, on terms that will equalize the disadvantages that they are at present placed under.

Hamilton, Ont.—The decision of the Government in lowering the duty on bituminous coal entering Canada will re-

sult in the building in this city of a $2,000,000 coke and gas plant by the United Gas & Fuel Company. This work will be commenced at once and will give employment to several hundred men. In addition to assuring a supply of millions of tons of coke every year, the new plant will supply coke gas at a low figure in various parts of the city.

Edmonton, Alta.—The following tenders were received for steam turbines, alternator and condensing plant, for the Edmonton power-house, and have been referred to the power-house superintendent for report: Allis-Chalmers Mfg. Co., (a) $103,815; (b) $106,350; James Howden & Co., Glasgow, $81,963; Willans & Robinson, Ltd., Rugby, Eng., $90,370; Escher Wyss & Co., $79,000; $78,400; $86,000; Laurie & Lamb, $96,750; $92,725; $93,475; Fraser & Chalmers, $87,100; $94,100; $87,300; Westinghouse Machine Co., $94,500; $112,875.

Municipal

Brandon, Man.—The city council are considering the question of installing an incinerator.

Aylmer, Ont.—The town council are considering the purchase of an incinerator.

Berlin, Ont.—A motor truck will replace the horses at No. 1 Fire Station, according to the decision of the city council on April 5.

Stratford, Ont.—Readings have been given to the following by-laws: Installing an incinerator, and an improved street lighting system.

Hamilton, Ont.—City Engineer Macallum will recommend enlarging the Trolley street sewage disposal plant, instead of building another near the jockey club as planned.

Victoria, B.C.—Additions to the city's water works distribution system will require 10,000 feet of 4-inch steel pipe. Bids will immediately be called for this material.

Toronto, Ont.—It is proposed to build a modern sewage disposal plant and drainage system for North Toronto, at an estimated total cost of about $4,145,000.

Wiarton, Ont.—A by-law will be voted on by the ratepayers on April 16, to authorize the granting of concessions to the Canada Casket Co., who propose to build a factory here.

Toronto, Ont. — A new centrifugal steam pump, capable of pumping 16,000,000 gallons of water in 24 hours will be installed in the main pumping station this month. The concrete intake pipe to connect with the pump has been completed.

Esquimalt, B.C.—At a special meeting of the town council held recently tenders for the supply of sewer piping necessary for the district's new sewerage system were opened. No action, however, was taken, the communications being referred to C. H. Topp, the engineer, for report.

Vancouver, B.C.—By-laws for civic capital expenditures for waterworks and probably other matters will likely be submitted to the electors in the course of a few months, the necessity for further money being evident from the discussion at the waterworks committee meeting held recently.

New Westminster, B.C.—City Engineer Blackman and a staff of men have commenced work making soundings on the site adjoining the present reservoir on Eighth avenue, Sapperton, where it is proposed to locate the large new reservoir, which will have a capacity of four million gallons.

Moose Jaw, Sask.—A by-law was introduced and read a second time at a city council meeting held on April 1, to raise the sum of $50,000 for the building of the exhibition grounds, race track, grand stand, stabling, and the making of the necessary improvements on the ground belonging to the city for that purpose.

London, Ont.—City Engineer W. N. Ashplant is calling tenders for storm sewers that represent an approximate expenditure of $125,000. The sections to be done first are: Egerton, Colborne, Adelaide and Ridout Streets, and Wharncliffe Road, an aggregate of 9.14 miles of mains and 2.66 miles of connections to gulleys.

Port Coquitlam, B.C.—By the unanimous adoption of recommendations placed before the council recently by the fire committee, this city will spend in the neighborhood of $10,000 for the purchase of fire equipment. Fire alarm signals and telephone call boxes will be a part of the scheme and it is also intended to purchase an auto combination ladder and hose truck at an approximate cost of $6,500.

Saskatoon, Sask.—Seventeen money by-laws, representing $475,000 capital expenditure of the city, will be submitted to the people for approval at an early date. The by-laws will include: Power house over expenditures, $15,000; pumping plant extensions, $10,000; electric light and power plant extension, $200,000; extensions to street railway, $25,000; water meters, $25,000; electric light and power plant service extensions, $85,000.

Victoria, B.C.—The city council has opened the tenders called for riveted steel pipe for the water conduit in connection with the Sooke Lake water system. One specification called for 5/16-inch steel pipe and the other for 3/8-inch. The tenders received were as follows:—From the Burrard Engineering Co. of Vancouver, (1) $112,750, (2) $211,250; from Hutchison Bros., (1) $120,950, (2) $221,390; from Fred V. Robertson, (1) $129,150, (2) $236,600; from Victoria Machinery Depot, (1) $132,225, (2) $251,810; from Moore & Pethick, (1) $141,860, (2) $238,628; from the Canada North-West Steel Co., (1) $148,625, (2) $274,625. No award will be made until a report has been furnished by the city engineer.

General Industrial

Berlin, Ont.— A building permit has been issued to Harry Tolton, who proposes to erect a shirt factory.

Calgary, Alta.—A firm in the States have written to the Board of Trade expressing their desire to appoint an agent to handle their asbestos products.

Nelson, B.C.—It is announced that a small plant will be built here to demonstrate the existence of platinum in this district.

Nelson, B.C.—The first shipments will be made this summer from the marble quarry owned by George Carruthers, of Winnipeg.

Stratford, Ont.—The city council have taken over the Kemp factory and are looking for a suitable concern to take possession.

Toronto, Ont.—Fire destroyed part of the tannery of H. B. Johnston & Co., River street. The loss is estimated at $10,000.

Vegreville, Alta.—The Alberta Farmers' Co-operative Elevator Co., will probably build a 60,000-bushel elevator here. P. S. Austin is a director.

London, Ont.—The Ford Motor Co. have purchased a site on which they will erect a brick building to be used as a distributing and service station.

Edmonton, Alta. — J. H. Lavalee, of this city, will build a paint factory. The contract for the construction of the building has been let to A. H. Harrer.

Tillsonburg, Ont.—It is planned to improve the town's fire fighting apparatus. A new and modern alarm system and a pump, with electric fixtures for rapid action, will be installed.

St. John, N.B.—The plant being erected by the Atlantic Sugar Refineries will be finished early this summer. The buildings are nearly completed and the machinery is being installed.

St. Thomas, Ont. — The Stacey Mfg., Co., Cincinnati, have offered to build another lift to the gas holder at the municipal gas plant. This will double the capacity, making the total 204,000 cub. feet.

Swift Current, Sask.—I. A. Welk and J. J. Nickel will build a flour mill with a capacity of 1,000 barrels a day. A unit having a capacity of 400 barrels will be built first and be in operation this fall.

Sarnia, Ont.—It is rumored that the Solvay Co. of Detroit is considering the location of a branch plant here. It is said the company is negotiating for land on the old Indian reserve, below the town.

Hamilton, Ont.—The new Buff Brick Co., which is situated near Rymal, will be able to start operations in the course of a couple of months. The firm expects to turn out 30,000 brick each day. Already they have received a number of orders.

Chatham, Ont.—Starting from an explosion, the cause of which is unknown, fire on April 10 completely destroyed the plant of the Canadian Wolverine Brass Co. on St. Clair street, causing a loss that is estimated at from $25,000 to $30,000.

Fredericton, N.S.—The lands of the Gibson Lumber Co. have been acquired by the Partington Pulp & Paper Co. The new property includes a large area of the best lumber lands in the Province of New Brunswick, situated along the Nashwaak River.

Sarnia, Ont.—A prominent manufacturing firm in the United States is looking for a good location at Point Edward, on which it intends to build a good-sized plant for the manufacture of a creosote preparation for use on block pavements and railway ties.

Belleville, Ont.—Fire did considerable damage to a cooperage owned by R. J. Graham of this city on April 7. The blaze started in the furnace room in the basement, which has not been used for some months, and worked up to the roof. The loss will be from $800 to $1,200.

Belleville, Ont.—Fire on April 7 destroyed a cheese-box factory in this city operated by Mr. S. T. Vandervoort. Some 500 boxes were burned, in addition to a large quantity of lumber. The loss to Mr. Vandervoort was about $1,500, which is partially covered by insurance.

Toronto, Ont.—The Public Roads and Highway Commission have submitted their report to the Legislature. The report recommends the expenditure of thirty million dollars on good roads throughout the province. The cost is to be shared by the province, counties and cities.

Berlin, Ont.—Oscar Rumpel, who has been superintendent of the Berlin Felt Boot Co. owned by the Canadian Consolidated Felt Co., has resigned his position to start an independent felt boot industry. He has leased the old William Greene and Rome building, and operations will commence in the near future.

Wallaceburg, Ont.—North branch farmers, acting in conjunction with the executive committee of Wallaceburg board of trade, have contributed $8,500, and the Dominion Sugar Co. has signified its intention to give $10,000, providing the town and Provincial Government add a similar grant toward the good roads work.

London, Ont.—Fire broke out in the factory occupied by the Rice Cigar Box Mfg. Co., on Ridout street, shortly before midnight on April 13, completely gutted the building and destroyed the plant and stock. The loss is about $26,000, of which only part is covered by insurance. The origin of the fire is not known.

Duncan, B.C.—A new and important industry is being established here by the Interior Hardwood Finishing Co., of which the general manager and president is O. J. Martin. The company has purchased seven acres of land and proposes to erect dwellings for its employees close to the factory where will be manufactured polishes, stains, etc.

Strathroy, Ont.—A factory consisting of two buildings will be erected to replace the plant of the Canadian Handle Co., which was destroyed by fire. The contract for their erection has been awarded to John J. Smith and work will start at once. The main building will be 180 x 40 feet and adjoining it will be a sawmill two storeys in height, 72 x 36 feet. The latest machinery is to be installed.

Iroquois Falls, Ont.—Excavations for the foundation of the paper mill, the largest of the several buildings composing the Abitibi Pulp & Paper Co. plant, will commence within the next few days. The mill will be ready for occupancy on June 1, but the construction of this building will not interfere with the starting of the machinery some time in May. Present plans are that wheels will turn at the pulp mill then. The paper mill will be 500 feet in length and nearly 300 feet in width.

Building Notes

London, Ont.—Building permits will be issued shortly for a $19,800 addition to the plant of Silverwoods, Ltd.

Calgary, Alta.—Plans for the erection of a 6-storey warehouse, for the Gutta Percha & Rubber, Ltd., are being prepared, estimated cost $50,000.

Medicine Hat, Alta.—It is announced that the Maple Leaf Milling Co., and the Ontario and Manitoba Milling Co., will start building operations in May. Each mill will have a capacity of 2,000 barrels.

New Incorporations

The Luxfer Prism Co., Ltd., incorporated at Toronto, capital $9,000, to manufacture luxfer prisms, etc., at Toronto. Incorporators: William Cowan, Harry B. Nicol, etc., Toronto.

William Markus, Ltd., incorporated at Toronto, capital $40,000, to carry on the business of contractors at Pembroke. Incorporators: William Markus, Joseph H. Bruck, etc., Pembroke, Ont.

Taxis and Motors, Ltd. has been incorporated at Ottawa with a capital of $200,000 to carry on business as manufacturers of automobiles in Montreal, Que. Incorporators: J. A. Ducharme, E. Halley.

Canadian Niagara Linens, Ltd., incorporated at Toronto, capital $300,000, to manufacture linen and cotton goods, etc., at Niagara Falls, Ont. Incorporators: Elena Duggan, William A. Bew, etc., Toronto.

Rotary Amalgamators, Ltd., incorporated at Toronto, capital $40,000, to manufacture and deal in mining machinery, at Toronto. Incorporators: Mervil Macdonald, Geoffrey Adams, etc., Toronto.

The Canadian Burrell Co., Ltd., has been incorporated at Toronto with a capital of $40,000 to carry on a general engineering and construction business at Windsor, Ont. Incorporators: J. C. Burrell, G. S. Middleton.

Cairnie & St. George Ltd., has been incorporated at Ottawa with a capital of $200,000 to carry on a business as engineers and contractors in Montreal, Que. Incorporators, L. McD. Cairnie and H. L. St. George.

The Ottawa Motor Transport, Ltd., incorporated at Toronto, capital $40,000, to carry on the business of cartage contractors, etc., at Ottawa, Ont. Incorporators: George D. Kelley, Charles H. Maclaren, etc., Ottawa.

Kel-Kee Cycle Car Co., Ltd., incorporated at Toronto, capital $40,000, to manufacture, buy and deal in all kinds of power-propelled vehicles at Toronto. Incorporators: James J. Maclennan, John N. Black, etc., Toronto.

The Port Stanley Mfg. Co., incorporated at Toronto, capital $40,000, to acquire the business carried on at Port Stanley by Lawrence W. Lee and Andrew C. Wiley, at Port Stanley, Ont. Incorporators: Nathan S. Cornell, Harley Taylor, etc., Port Stanley.

Tenders

Victoria, B.C.—Sealed tenders will be received by the undersigned up to Monday, May 4, 1914, for the supply of 10,000 feet of 4-inch steel pipe for water works purposes. W. Galt, city purchasing agent.

Winnipeg, Man.—Tenders will be received up till April 30 for the manufacture, delivery and erection of two 3-phase synchronous condensers. Plans and specifications may be obtained from the City Light and Power Department, Winnipeg, Man.

Ottawa, Ont. — Tenders addressed to the undersigned, at Ottawa, will be received up to noon of May 4, for the construction of a steel single screw hopper barge, to be delivered at Sorel. Full information and specifications in connection with the above can be procured on application from the purchasing and contract agent, Department of Marine and Fisheries, Ottawa.

Toronto, Ont. — Sealed tenders addressed to the undersigned will be received at this office until 4.00 p.m., on Monday, April 20, 1914, for the supply of electric material, including transformers, switchboards, nameboards, conduit, etc., as per plan, list and specification. These and forms of contract can be seen and forms of tender obtained on application to R. C. Desrochers, Department of Public Works, Ottawa.

Ottawa, Ont.—Sealed tenders addressed to the undersigned will be received until Monday, April 27, 1914, for the supply of "brooms and brushes," "chain," "hardware," "hose," "oils and greases," "packing," "paint, paint oils, etc."; "manila rope," "wire rope," and "steam pipe, valves and fittings," for the departmental dredging plant in Ontario and Quebec. Combined specification and form of tender can be obtained at the office of A. E. Dubuc, Esq., District Engineer, Montreal, Quebec; J. E. Sing, Esq., District Engineer, Toronto, Ont., or as under. R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Toronto, Ont.—Tenders will be received up to noon Tuesday, April 28, for the supply and installation of cold storage equipment in the Toronto Municipal Abattoir, situated on Tecumseh street. Tenders will be received in bulk for the ice machine equipment complete, including piping, cork insulation, floors of freezing rooms, cold-storage doors and windows, electric wiring, plastering, painting, tracking, conveyor, motors, scales, racks for freezers, etc. Specifications, tender form and all information desired may be obtained upon application at the office of William R. Perrin, 530 King street east, Toronto, Ont., or 200 Old Colony Building, Chicago, Ill.

Wood Working

Toronto, Ont.—The Canada Furniture Manufacturers, Ltd., have asked the private bills committee for power to sell their plant and properties to pay off liabilities and to transfer some of the stock of the old company into a new company to be organized.

ASSOCIATION AND PERSONAL

A Weekly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Machinery Circles

Personal

E. S. Fraser, C.E., has been appointed town engineer of New Glasgow, N.S.

H. Cameron, who has just arrived in this country from Glasgow, has taken up his duties as assistant manager of Canadian Vickers, Ltd., Maisonneuve, P.Q.

W. H. Childs has been appointed assistant manager to the Hydro-Electric Commission, Hamilton, Ont., at a salary of $1,500 per year.

J. W. Battershill, at present on the staff of the city engineer, Winnipeg, has been appointed engineer to the municipality of East Kildonan, Man.

Carr L. Glasgow, until recently district manager of Allis-Chalmers-Bullock, Ltd., Montreal, has entered the service of Fairbanks, Morse & Co., New York.

E. T. Sifton, who has been consulting engineer for some time to the Hydro-Electric Commission, Hamilton, has been appointed general manager at a salary of $4,500.

Graham Drinkwater, vice-president of the Canadian Fairbanks-Morse Co., who has been confined to his home with pneumonia since last week is reported to be making satisfactory progress towards recovery.

Manitoba University. — Dr. H. R. Armes, lecturer in chemistry, has been promoted to the rank of assistant professor and J. W. Dorsey, lecturer in electrical and mechanical engineering, is now assistant professor.

Frank Neal, who has been general superintendent of the Eastern Car Co., has severed his connection with the plant, and leaves shortly for Pittsburg. Previous to going to New Glasgow Mr. Neal was superintendent in the Halifax car shops.

William Newman, works manager of the Polson Ironworks, Ltd., Toronto, has been appointed, by the Vessel Fire Register, New York, chief inspector for the Canadian department of this company. Mr. Newman's duties will consist of appointing local inspectors in the different ports and issuing certificates of classification on their various reports. All boats carrying certificates are granted a reduction in fire insurance rates by the various insurance companies.

Arthur L. Mudge and A. Leo Mieville have become associated with Kerry & Chace, Limited, consulting engineers, Toronto, as managers of the electrical and mechanical branches, respectively. Mr. Mudge was for over four years chief electrical engineer in the Toronto office of Smith, Kerry & Chace, while Mr. Miéville was until recently engineer in Canada for W. H. Allen, Son & Co., Bedford, England.

Henry Beatty, for many years a proprietor of steamers on the Upper Lakes and formerly manager of the Canadian Pacific Lakes Service, died last Friday at his residence, 207 Simcoe street, Toronto, after an illness of two days. He had been in failing health for some months, but was able to be at his office as recently as Wednesday. Mr. Beatty was born at Cootehill, County Cavan, Ireland, eighty years ago, and came to Canada when he was nine years of age.

WHO'S WHO.

C. ANTONY ABLETT.
Manager, Siemens Co. of Canada, Ltd., Montreal.

The Regina Engineering Society held a very successful and enjoyable informal smoker on April 9, in the Civil Service Association rooms at the Parliament Buildings. City Commissioner L. A. Thornton occupied the chair, and during the evening the following programme was rendered: Pianoforte solo, M. L. Allen; song, Mr. Herbert Davies; step dance, Mr. Fred Gage; mandolin solo, Mr. H. S. Shope; song, Mr. J. B. Edie; elocution, Mr. R. E. Davies; song, Mr. W. Laird; selection, Mr. F. R. Hoole; flute solo, Mr. G. Watts; step dance, Mr. W. McGregor; raconteur, Mr. W. R. Harris; song, Mr. Wynne Roberts; accompanist, Mr. A. J. Leigh.

Trade Gossip

Rock & Power, Ltd., Royal Bank Building, Toronto, have been appointed exclusive agents for Canada for the Union Boiler Works, Erie., Pa., and the Erie Engine Works, Erie, Pa.

W. H. Banfield & Sons, Toronto, are filling the order received by the International Mail Equipment Co. of Canada, Toronto, for 100,000 rural mail boxes from the Dominion Government.

The Hare Engineering Co., Ltd., Toronto, are installing two 80-h.p. Fulton water cooled mechanical stokers in the plant of the Berlin Light Commissioners, Berlin, Ont.

The Hare Engineering Co., Ltd., Toronto, have secured the order for nine 316 horse-power Fulton water cooled mechanical stokers for installation in the New Glasgow plant of the Nova Scotia Steel & Coal Co.

Chapman & Walker, Ltd., Toronto, have secured the exclusive agency for the General Electric Co. of England, in Canada. This includes all products of the General Electric Co., and allied concerns with the following lines: A. C. & D. C. motors; A. C. & D. C. generators; turbo generators; lamps and steam turbines. The General Electric Co. have branches in nearly all countries of the globe, and the company have a capitalization of $7,500,000.

Winnipeg Shipbuilding.—With the building of a steel steamboat for trading by the Hudson's Bay company in the far north, Winnipeg has given birth to a new industry. The builders are the Doty Engine Works. Constructed specially for the navigation of the shallow rivers in the north, the boat is 150 feet long with a 28-foot beam. The new steamer has been put together at the works of the builders in Winnipeg and will be taken down and shipped to Fort McMurray, where the different sections will be re-assembled. The engines will be installed at the northern post.

Toleration Limits in Interchangeable Manufacturing

By John Edgar

The establishment of proper limits in the process of manufacturing does away with the exercise of the operator's judgment, besides eliminating the scrap pile and reducing production cost. The primary determination of limits should be, however, the work of one who knows thoroughly the requirements of the particular case.

THE success of modern manufacturing is based on interchangeability of the product both as a whole and in its details. Interchangeability to be practical is dependent on the toleration of variances in the sizes of the parts which when assembled make up the whole mechanism, unit or machine. Variance is the difference in the dimensions of the part from the specified or nominal figure. This variance must be kept within a predetermined limit in order that the parts will assemble without fitting, and must be carefully determined in order that the cost of manufacture be held down to the lowest possible point, and, at the same time, the quality be maintained.

Interchangeability is often misconstrued to mean and to be applied only to the most accurate work, and for a long time was considered to apply to precision work only, whereas it is entirely of a different nature. Interchangeability in precision work is the result of having the dimensions up to the specified figure without variance and having each part an exact duplicate of any similar part. From this we may judge that precision work is a rare thing, and what is commonly called precision work is merely interchangeable work made to narrow limits. Precision work will in most cases be found only in the most accurate tools, whereas interchangeable work is applicable to any class of product from the manufacture of farm machinery to the finest watches, and is all based on the same principle—that of toleration limits.

Selection of Limits.

The range of the limits is to a large extent the result of previous experience, and in many cases will have to be changed in the course of time to check up with other elements that enter into the manufacture of a product. It is the intention here to point out some of the considerations that have to be met in the selection of the limit, and to correct the erroneous idea that the limits may be set arbitrarily to some fixed rule in which the peculiar conditions of each case are to be ignored.

The conditions that enter into the proposition of fixing the toleration of sizes are many in number, and may include the following:—

The design of the part; the work it has to do; its relation to other parts with which it works; the accuracy of movement; wear and its effect on the function of the part and its relation to the action of the mechanism as a whole; lubrication and its reliability; method of manufacture; the economical accuracy that can be maintained in the manufacture of the part and in those with which it is connected; the effect of temperature on the part as developed by the action of the part or its associates due to friction; maintenance of the alignment of the parts or their bearings, etc.

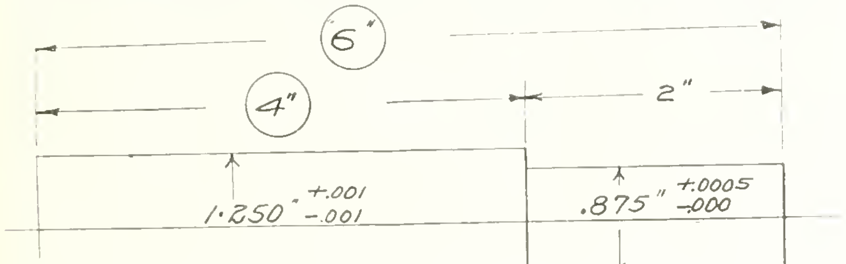


FIG. 1. DESIGNATING THE DESIRED ACCURACY.

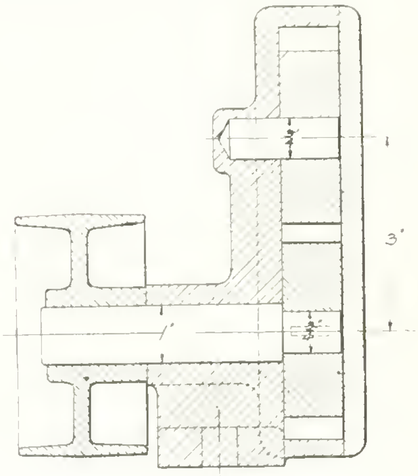


FIG. 2. SECTION THROUGH BODY OF GEARED PUMP.

The paramount consideration in the manufacture of a product is to make it in an economical way so as to answer the purpose in the best manner possible at reasonable cost. To do this, the product must be made in sufficient quantities to warrant the expenditure of a considerable amount of money in the making of jigs and fixtures to handle the work expeditiously so that the unit cost chargeable to the fixture expense is small per piece. Having made provision for the manufacture of the parts in quantities, the question of assembling the units must be considered. Before the jigs and fixtures are made, the question of the closeness of the sizes is to be considered, as the accuracy and the cost of the fixtures, as well as their design, depend on the determined limits of manufacture. We see, therefore, that the establishment of the limits is the first consideration after the design of the product is decided upon and some changes even in the design of the parts or the mechanism may have to be made when the toleration limits are studied.

The common use of the micrometer is liable to get one into the habit of working to too close limits in many cases where a wider range of tolerance is permissible, and much time is wasted on the production of many machine details because of the absence of the limiting sizes, and all work should be made with the permissible limits of variance in mind. These limits should be on all

drawings, especially when parts are made in different departments and assembled in still another. The too close working to the dimensions on the drawing is as bad as careless working, for, without some way of designating the permissible variance, there is no common basis.

Designating the Desired Accuracy.

To designate the accuracy expected in a part, the dimensions are put on the drawings with this in view. Thus, when dimensions appear in ordinary fractions, the accuracy is to be assumed to be as close as is possible with the engine divided scale, and may be taken to be either .005-in. larger or ..005-in. smaller than the nominal sizes. Some instances in which it is desired to indicate wider variance, the dimension is placed within a circle, which is meant to read inches, a variance of 1/64 in. above or under being tolerated. Dimensions that have to be kept within closer limits than .005 in. over and under are written in decimals with the tolerance indicated either by writing the two dimensions within which the size is to be made or by giving the nominal dimension of the part and stating the plus and minus variance above or below which the size must not measure. The latter is more common practice. These methods are illustrated in Fig. 1. When a size is given in a decimal only, without limit, the size is meant to be held to that dimension without limit, and we have a case of precision work. There are many drawings put out which have no means of showing whether the work is precision work or not, and no up-to-date manufacturing concern will take a job to do in which some limits are not given either directly or implied. The term "ordinary commercial limits" is rather a vague quantity, and is the cause of a great deal of litigation and misunderstanding.

The maintenance of the sizes indicated on the drawings is made possible by the use of limit gauges on a large class of work, while the use of the micrometer obtains on the majority of cylindrical work and on such work that would not warrant the expenditure of the amount of money necessary for special gauges for short orders.

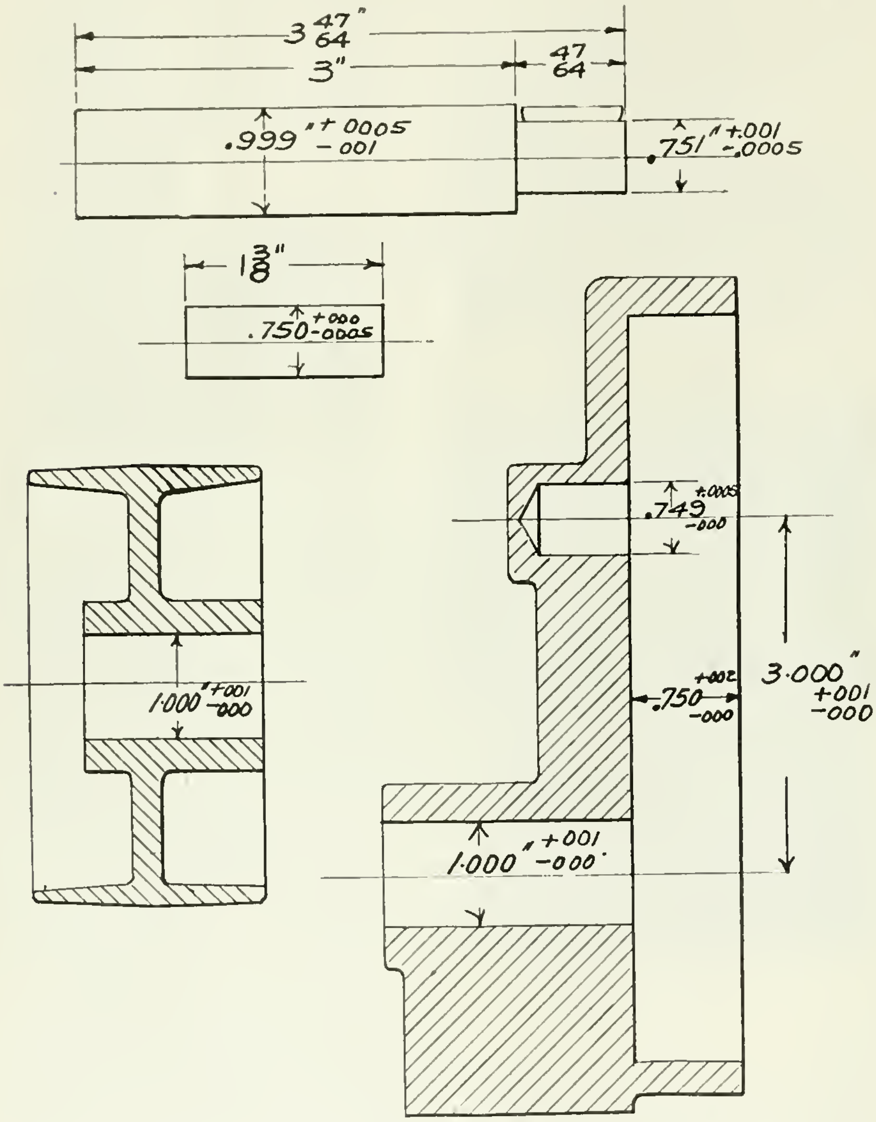


FIG. 3. DETAILS OF GEARED PUMP DIMENSIONED FOR PRODUCTION DEPARTMENT.

In establishing the toleration of variances, the fact that the maximum size of the entering part must not exceed the minimum size given for the receiving dimension may seem an unnecessary precaution to note, but while this is so, in many cases the reverse is found on the drawing. On the other hand, the minimum of the entering piece must not be so low as to cause undue play in the joint when the two extremes are assembled.

Practical Example.

As an example of the method that will bring the best results, let us take the case of the parts in Fig. 2, which is the section through the body of a geared pump, the dimensions being the nominal sizes as they would appear on the general design drawing. The parts in detail are then fully dimensioned for the production department, and appear much as shown in Fig. 3.

Take the shaft which is made with two sizes—one for the pulley and bearing, and the other for the gear; the 1-in. size is to have an average measurement of .999 in. between the limits of plus .0005 in. and minus .001 in., making a variance of size of one and one-half-thousandths inch. These figures are chosen from the fact that most reamers cut about one-thousandth large when new, and that the space for the lubricant should never be less than one-half-thousandth, and the hole should never be under the nominal size of 1 in. The hole is made with an allowance or tolerance of one-thousandth, which under ordinary usage gives the reamer an economical life. The maximum difference between the shaft and the hole is two-thousandths, a permissible shake in a case of this kind. The average of all the product will have an oil space of one-thousandth. As the shaft is ground, the limits are well within present practice in economical production.

Had we made the limits with the same toleration above and below the nominal size of the shaft and hole, we would have had some shafts that would not enter the hole, and, consequently, would require fitting which is not, in the true sense, interchangeable production.

The fit for the gear on the end of the shaft is nominally ¾ in.; but since this is to be a light press fit, the average size for the shaft is given as .001 in. larger, or .75 in., with the variance of .0005 in. above and the same below the average. The hole in the gear is dimensioned an average size of .750 in., with the usual limit of .001 in. above and .000

in. below. This makes the extreme sizes for the shaft and hole vary from a fit of .001-in. drive to a light push fit, with hole and shaft of same size. This latter is not likely to obtain, as the shaft will be kept above the lower limit in the general run of work.

The case of the pulley is different, the hole being kept within the usual limits for holes, and being dimensioned .750 in. + .001—.000. The shaft is made the same size the full length of the 1 in. part, and the variance in the fit of the hole in the pulley and the shaft is from one with .003-in. shake to one with .001-in. play. This is a loose fit, but, as the pulley is held with a set screw, it is permissible.

In the case of the stud, the limits are closer. This is so as to get a force fit in the hole, the limits for which are also made closer, being .750 in. + .0005—.000. In this way the total tolerance in the fit is but one-half-thousandth. The tolerance in the fit of the idle gear on its stud journal is .002 in.

These instances of different fits show the use to which the established limits are put, and is the only safe way to carry on a manufacturing business in which quantity production is the idea. The establishment of proper limits does away with the human element in judging the allowance necessary for different classes of work, besides eliminating the scrap pile and reducing the cost.

The establishment of these limits must be made by one who knows the requirements of the case, because if done in a careless manner they are worse than none at all, as the additional care in working between the limits is wasted. The ultimate results, also, are liable to cause a disrespect for specifications on the drawings, and thereby tend to make them unreliable in their proper sphere as working data. The confusion resulting from such a condition is much met with in many small establishments in which little or no system, as indicated, is found. It places these small shops at a disadvantage when competing with the larger and better handled concerns.

The natural companion to the system of the limits is that of competent inspection. It gives the inspector a field in which to work, with stated limits within which a tolerance of variances is allowed.

Observations on Breakdowns of Gear Drives

By Michael Longridge

The accompanying article is an abstract from a paper read recently before the Graduates' Section of the Institution of Mechanical Engineers. The fact that faulty design and careless installation have played an important part in many "smash-ups" makes the data here given of considerable value to those whose work lies in these particular directions. The author is the well-known Chief Engineer of a large and leading machinery insurance corporation.

SPUR GEARING.

ABOUT 1879, when horizontal engines of 800 to 1,200 I.H.P. began to replace beam-engines of half that power in cotton mills, when pitch-line speeds were rising from 1,800 ft. to 2,300 ft. per minute, loads on teeth from 10,000 lbs. to 18,000 lbs., and gear ratios from 2¼ to 1, 3 or 3½ to 1, an epidemic of breakages of spur-gears set in. Some 20 per cent. of the engine breakdowns were breakages of spur-wheels on engine crank-shafts, and the pinions driven by these wheels broke almost as frequently. Many of these breakdowns were due to irregularities of pitch, twisted teeth, sinuosities of pitch circles, concentration of pressure on the end of teeth through movement of crank-shaft, back-lash from the momentum of rope-drums on second-motion shafts, and other faults of workmanship and use, common to old-pattern moulded wheels and to old engines.

The damage, however, was not confined to these. Many new wheels, as good as mechanical skill could make them, with teeth moulded by machinery, spur-runs, cast in complete circles, and machined internally, carried on crank-shafts held in pedestals, with brasses adjustable horizontally as well as vertically, broke also. These breakages were usually attributed to "vibration," "wear and tear," "teeth bearing up to points," and similar effects of a cause ignored or not discerned. That cause, in my opinion, was the use of teeth too long and too wide to "correspond with their environment," the most important fact of that "environment" being the unavoidable motion of the engine crank-shafts on which the driving-wheels were hung.

Spur Gear Breakage Explanation.

I will try with the aid of Figs. 32 to 35 to make this clear. Fig. 32 represents three teeth (A), (B), (C), of a spur-wheel geared with three teeth, (D), (E), (F) of a pinion. The teeth are supposed to be cycloidal, for involute teeth have not found favor with makers of main driving-gear. Their length is exaggerated to make this illustration clear. Similar profiles can be set out, according to the rules in the books to provide three points of contact (x), (y), (z), and three teeth to carry the load. They look very pretty upon paper, but they will not work if the spur-wheel (A), (B), (C) be forced towards the pinion (D), (E), (F), by the motion of the shaft.

The contact at (y) ceases. The pressure is taken off (B) and is concentrated upon the points of the teeth (C) and (D), and there intensified enormously by the forcible retardation of the driving-wheel or acceleration of the pinion. Again, even if the crank-shaft could be held absolutely steady, the same effect might be produced if the teeth came from the mould full at the points, or if the pitch-line had proud places, both common defects in uncut wheels. If, however, the faces of the teeth were cut away sufficiently to limit the contact to the immediate neighborhood of the pitch-point (y), the motion of the wheel towards the pinion would simply cause the tooth (B) to slide on (E) without strain or change of angular velocity.

Of all intermediate positions of the point of contact it may be said that the further it moves from the pitch-point, the more destructive become the effects of shaft displacements, incorrect tooth forms, or sinuosities of pitch lines, and conversely the shorter the path of contact the less the mischief resulting from these unavoidable irregularities. Experience has led millwrights to the same conclusion, for they invariably set out wheel teeth so fine at the points and roots that they bear only near the pitch line when new, and when through wear the bright bearing surfaces extend to the points of the teeth, they chip the points to avert the damage just referred to.

The question is, why do they leave surfaces which are not used when the teeth are new and which have to be chipped off when the teeth are old. To this I never could get a satisfactory answer. Neither as far as I know, would wheel makers cut short their teeth till 1888, when a firm of engineers consented to make a pair of wheels with short teeth, Fig. 33, for their own shop engine.

These wheels must have felt like the first lady who appeared in public minus a crinoline, so greatly did they differ from the fashion of their day. They had 49 and 47 teeth, of 2 5-8 in. pitch, 15-16 in. long and 4 1-2 in. wide, the ratio length to pitch being 0.36. With fixed

centres and accurate moulding, teeth 1-4 in. long would have kept contact. These wheels held their grease well and ran smoothly, till the engine was replaced in 1892. They were but small, and running at a low speed (1080 ft. per minute), but they were more convincing than arguments or drawings, because they were made of cast iron and could be seen at work.

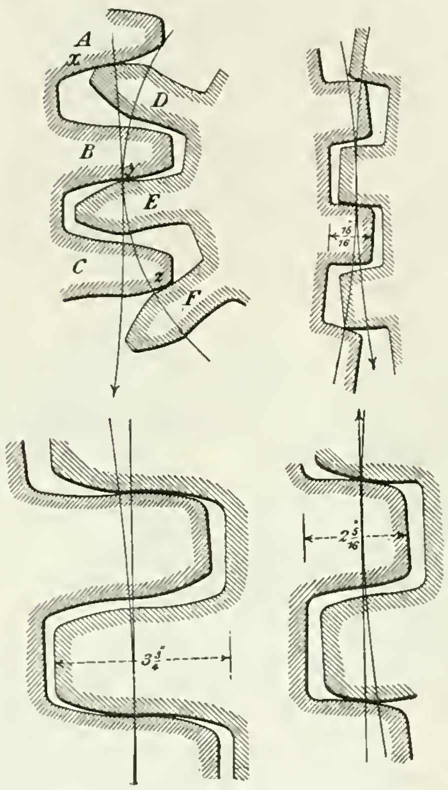
Figs 34 and 35 show what they accomplished in a few months. The former shows the teeth of a wheel and pinion installed in November, 1888, after two other sets of gearing had been destroyed in the space of eleven years. The teeth were 4 13-16 in. pitch, 3¾ in. long, and 19 in. wide, while the distance between the centres of the shaft-bearings was only 66½ in. With these dimensions and a pitch-line speed of 2410 ft. per minute, the motion of the crank-shaft threw the whole load of 16,400 lbs. upon the corners of the teeth and drove the points of the pinion-teeth into the flanks of the wheel-teeth with jar and vibration sufficient to break one of the segments in the following March. Then more teeth were cracked and more segments broken, and it became necessary to replace the entire rim. The new rim was made of steel, with teeth of the same pitch and breadth as the old, but 2 5-16 in. instead of 2¾ in. long, Fig. 35. They would have been better 1½ in. long.

The tooth of an engine-driving-wheel is a cantilever whose strength varies not as $\text{pitch}^2 \times \text{width} \div \text{length}$, but as $\text{pitch} \div \text{length}$, because, with a short and moving crank-shaft, very little, if any strength is gained by making the width of a tooth more than one pitch. Thus a reduction of length to 1½ in. would have permitted a reduction of pitch to 3¼ in., an increase in the number of teeth in both wheels, a shortening of the necessary path of contact, and, if three pitches be considered a sufficient width for the teeth of one engine driving-wheel, as I think it is, less concentration of pressure on the corners from the lifting of the shaft.

Double Helical vs. Straight Teeth.

Some people consider double-helical teeth stronger than straight teeth. This is a delusion. Width for width of wheel-face, they are much weaker, because, owing to the lifting and end-long motion of crank-shafts, the pressure never acts on both treads at the same time, unless provision be made for allowing the pinion-shaft to move end-ways, and, even, then, the force required to overcome the inertia of the pinion and its shaft adds seriously to the pressure on the teeth. There is another cause of destructive vibration—namely, irregularity of pitch and inequality of pitch of wheel and pinion. The first is seldom important in machine-moulded wheels, and can generally be rendered innocuous by chipping and filing. The second, depending upon the contraction of the castings, can only be remedied by gearing the wheels more or less deeper than was intended by the designer.

In my opinion, both wheels of a pair should have pitch circles turned on both sides of the rims, with radii proportional to the number of teeth in each, whether they be the radii marked on the drawing or not. The wheels should be geared to these circles and kept there. The change of the position of the pitch-point on the profile will not materially affect the velocity ratio if the teeth be short. The fashionable length of teeth is now 0.45



FIGS. 32, 35. SPUR GEAR TEETH BREAKAGE FEATURES.

to 0.55 of the pitch, instead of 0.66 to 0.75 as formerly, and it might be reduced still more with advantage in many cases.

I should like to have said something about the breakages of spur-wheels other than breakages of teeth, but as most of the breakdowns of these wheels originate in the teeth, it seemed best to devote the time available exclusively to them. The breakages of spur-gearings are now 10 per cent. of the total breakdowns. The reduction in the percentage from 20 to 10 is principally due to the supersession of gearing by ropes. The improvements in design and workmanship have done little more than enable wheels to live under conditions which the old wheels could not have faced, but they have done something, and the substitution of steel for iron, of cut or milled for moulded teeth, and of shorter teeth and correspondingly finer pitches, will do a little more, but I doubt if it will ever be possible to transmit more than, say, 1200 horse-power from the crank-shaft of a steam-engine by spur-gearing.

NO RULES FOR SUCCESS.

WRITING in Pitman's Magazine, a new English publication devoted to business, A. E. Bull outlines the kind of people it is necessary for the man to know who would find success in the commercial world. Says Mr. Bull:

"A remarkably successful man, who had commenced in poverty and who had built up a world-famous business, was once asked to explain the secret of his success.

"'My dear man,' he said to the interviewer, 'it can't be done. I can no more tell you how I succeeded than a bird could explain how it learned to fly.'

"'But,' protested the interviewer, 'you surely have some rules of conduct and business methods that you have adhered to through life, and which would account for your success?'

"'Yes, I have rules,' replied the successful man, 'but rules are nothing. Success isn't a matter of rules. It's something inside a man, something that belongs to his nature and character. If a man has it, he will succeed; if he hasn't, all the copy-book headings in the world won't give it to him.'

"That was the opinion of a man who had succeeded and knew his own nature, and, up to a point, it has a great deal of truth in it.

"Here is a second reply to the question which was put to the millionaire. The man who made it was by no means so prosperous, but he had succeeded beyond reasonable expectations. He was certainly more successful than those who knew him best thought he would be, for he was not a particularly able man in any way.

"'I made one rule in life,' he said. 'I regard it as a duty to succeed, so I persistently sought the company of those who had succeeded. If a man was a failure I avoided him, not out of any snobbishness, but because I could not afford to run the risk of catching the infection of failure from him.'

"The things that bring success are the things that belong to character. To succeed one must mold the character aright. Nothing influences character so much as companionship. In his mind it worked out this way: Make companions of weak people and one becomes weak, make companions of strong people and one becomes strong."

Description of a Testing Plant for Centrifugal Pumps

A testing plant for centrifugal pumps has been built at the works of Canadian Allis-Chalmers, Ltd., Rockfield, near Montreal, which can be reckoned, without fear of contradiction, we believe, as one of the best equipped and most up-to-date hydraulic laboratories on this continent.

A CENTRIFUGAL or turbine pump is not a positive displacement pump and there are no "rule of thumb" methods of arriving even approximately at its capacity. It may be accepted then that a well-equipped testing plant is one of the most important essentials for the successful manufacture of centrifugal pumps.

From the manufacturer's standpoint the records of tests carefully carried out are of the utmost value, as they constitute the foundation upon which future propositions can be based, designs developed, improved and modified to suit particular requirements. From the purchaser's standpoint, on the other hand, is the absolute assurance that the hydraulic and efficiency requirements have been fulfilled and, secondly, that a trial run of several hours' duration will insure continuous operation of the machine with no mechanical difficulties arising after leaving the works.

There are a number of testing methods in use with varying degrees of accuracy, and they may be classified as follows:

(a)—Weight or volume method.
(b)—Weir method.
(c)—Velocity meters.

The last group includes Venturi meters, nozzles and the Pitot tube.

The instruments required, pressure and vacuum gauges to determine the total head; watt meters to determine input to motor, or indicator to determine horse-power of steam engines, have long been standardized and are usually accepted without question by consulting engineers and representatives of purchasers on official tests; in any case their calibration is a simple matter and facilities are provided for this purpose at the Rockfield Works. The measurement of the quantity of water being handled, however, presents many difficulties, because the methods generally adopted, owing to their cheapness, such as weirs, nozzles, pitot tubes and, in fact, all velocity meters, are open to the very strong objection that their accuracy depends on constants determined by experiment which, as far as consulting engineer or official representative is concerned, may or may not be right. A means of direct measurement either by weight or volume is an absolute necessity.

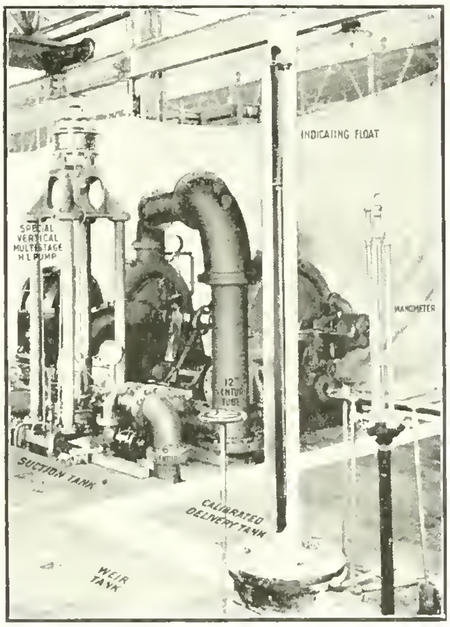


Fig. 2. CLOSE VIEW OF MANOMETER AND FLOAT

Test Plant Details.

In the testing plant at the Rockfield Works, no one single testing method has been relied upon, but any one of the three above-mentioned testing methods can be used and the volume method can be used to check either the Venturi meters or the weir. It may be stated here that a testing plant established at the Mather & Platt Works, in Manchester, England, whose well-known centrifugal pumps, Canadian Allis-Chalmers, Ltd., have successfully manufactured for several years, served as a basis for the design of this unique equipment.

Figs. 1 and 2 represent general views of the testing plant and, referring to Fig. 3, the overall dimensions of the tanks alone, which are 34 ft. 6 inches long, 18 ft. 3 inches wide and 9 ft. 4

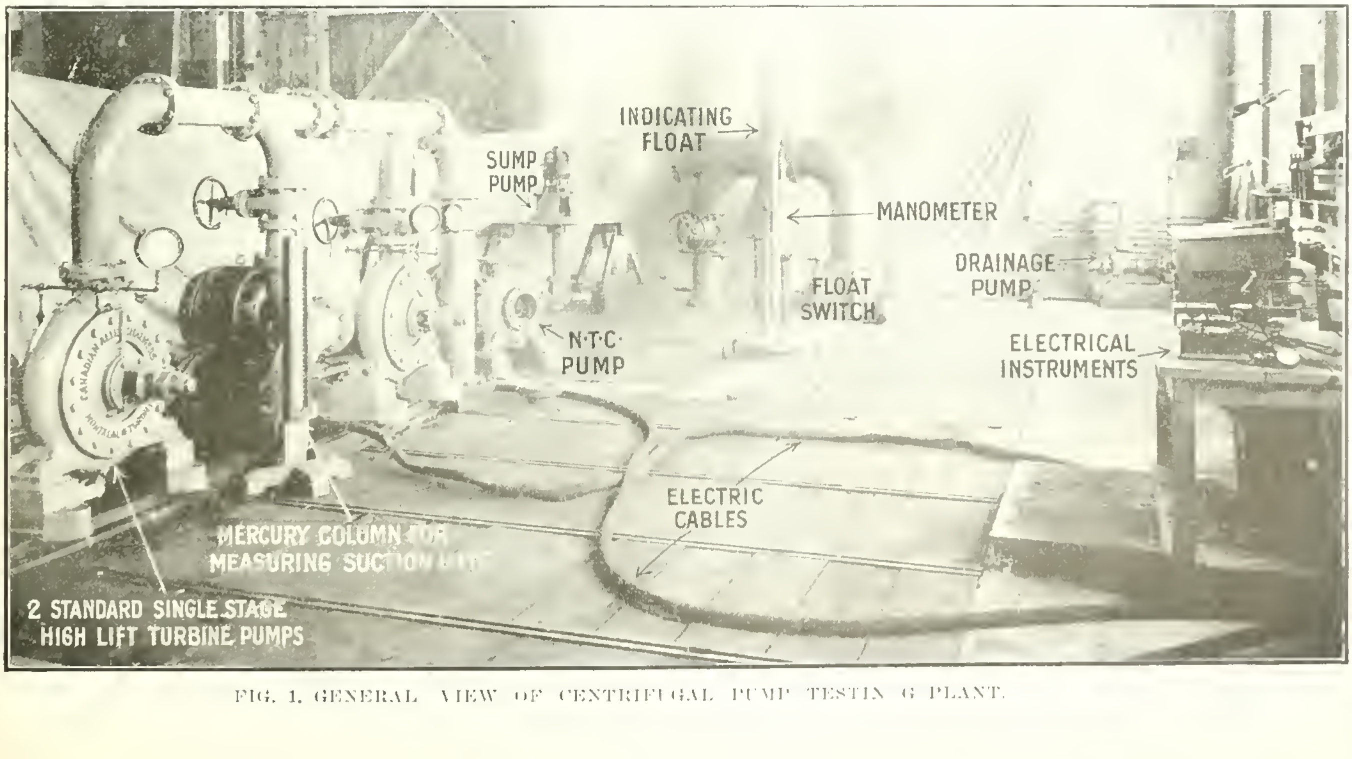


FIG. 1. GENERAL VIEW OF CENTRIFUGAL PUMP TESTIN G PLANT.

inches deep, will satisfy the reader that an equipment of such proportions is well able to cope with the largest pumping units. It can be seen that all tanks have been placed underground so that factory space is not wasted and the flooring made in such a way that the tanks can be easily uncovered. The total area has been divided into three tanks. The suction tank is 18 ft. 3 inches long, 15 ft. wide, 9 ft. 4 inches deep. The calibrated delivery tank is 18 ft. long, 11 ft. wide, 7 ft. 4 inches deep, and the weir tank is 18 ft. long, 5 ft. 9 inches wide by 7 ft. 4 inches deep.

All tank walls are made of waterproofed concrete and the bottoms carefully leveled. By raising the bottom levels of delivery and weir tanks above the suction tank, they drain by gravity through connecting valves into the suction tank. A small motor-driven centrifugal pump, which can be seen in the right-hand corner of Fig. 1, serves as drainage pump for all tanks. Suction pipes with foot valves and strainers of various sizes may be noted in the suction tank, and little time is lost in making the suction pipe connections when pumps about to be tested are bolted to the cross rails, thus providing a firm setting-up.

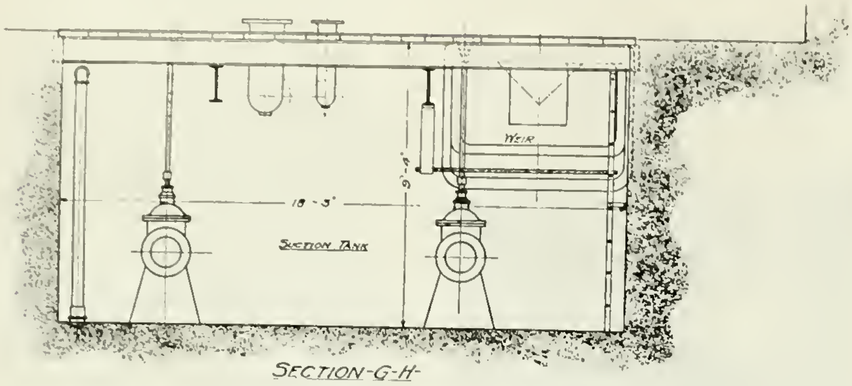


FIG. 4. CROSS SECTION OF SUCTION TANK.

The discharge connections are formed by two elbows, a 6-inch and 12-inch which connect to a 6-inch and a 12-inch Venturi meter respectively. Following the discharge pipes, they are carried to a common large pipe, which finally connects with a water switch, the function of which will be described later. By removing a blank flange, a passage can be made from the delivery tank to the weir tank. On the wall dividing the delivery tank from the weir tank can be seen a Manometer which, by means of pipe connections to the Venturi meter tubes, registers the amount of water flowing through the tubes. Next to this instrument is mounted a float with indicator which shows the height of water in either delivery or weir tanks by opening and closing valves.

Referring to the weir tank, the cast iron weir frame may be noted which is set in the wall dividing the weir tank from the suction tank. Weirs of the V-notch shape, and rectangular weirs of 18, 22, 24, 35 and 48-inch widths can be inserted in this frame. A ladder with a platform has been provided to allow the test operator to descend and observe the leveling and careful setting of the weir crest to the zero mark of the float scale.

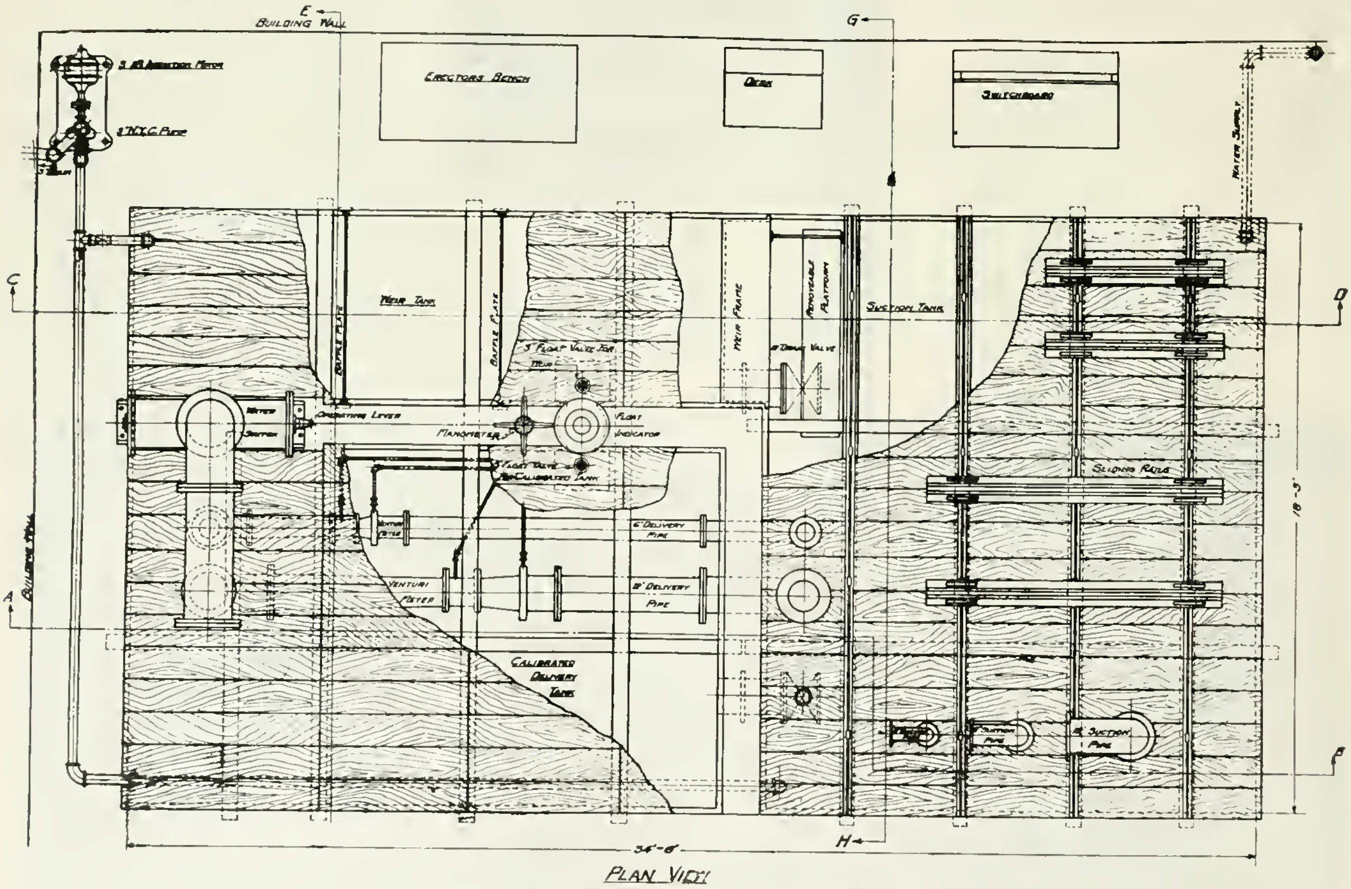


FIG. 3. PLAN OF TANKS SHOWING LAYOUT OF METERS AND PIPING.

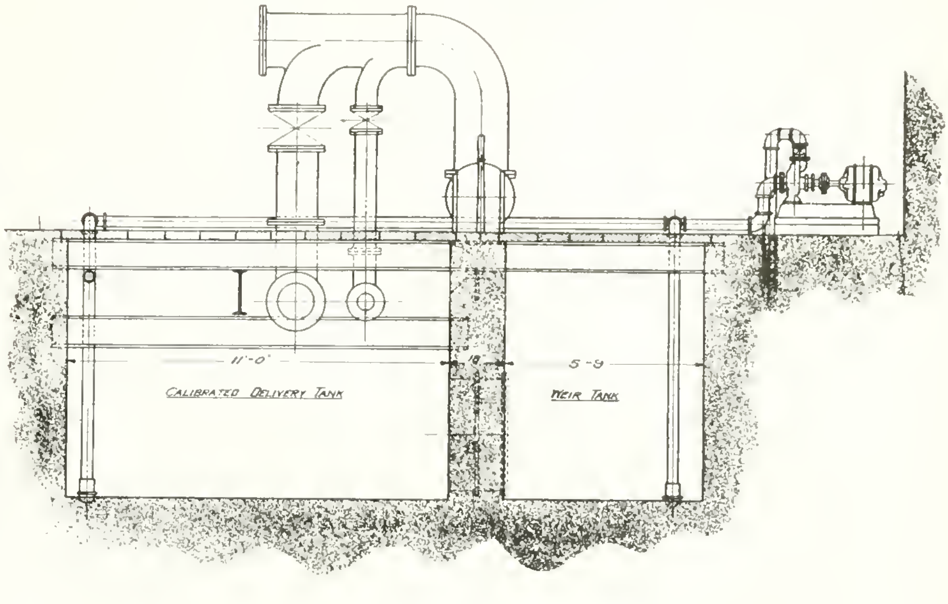
Baffle plates in the weir tanks can be raised or lowered in wall frames to best advantage to check any disturbances of the water and to insure a quiet flow near the weir. A table with the necessary electrical instruments to measure the

electrical input, and engineer's desk and a fitter's bench complete the equipment.

Method of Test.

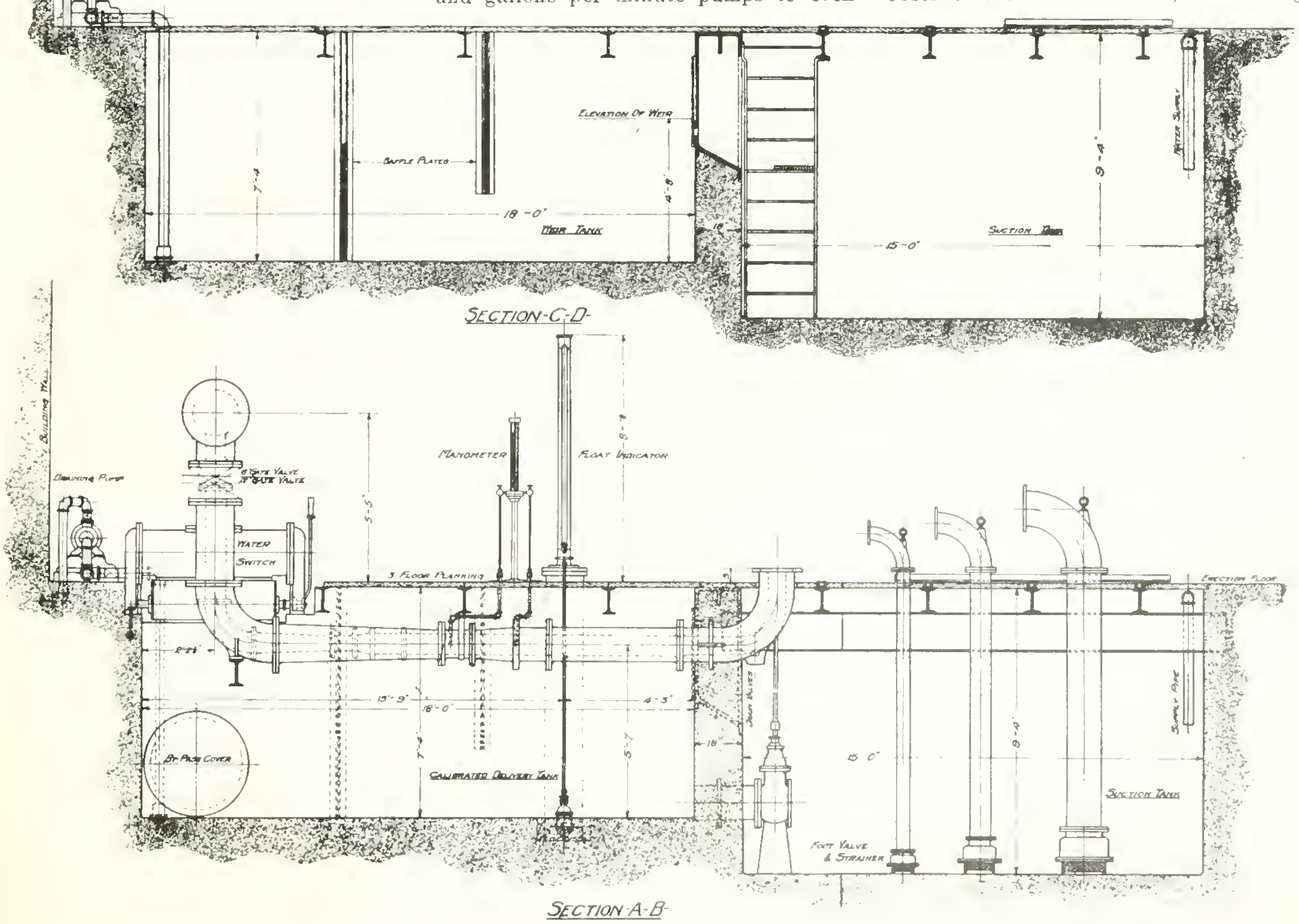
The method of test is as follows: All suction pipe connections are made with the above-mentioned pipes in the suction tank. The discharge connection is made with one of the two elbows, according to the size of pumps to be tested, and the water is discharged direct into the water switch. By operating the hand lever, the water can be instantaneously switched either into the calibrated delivery tank, or into the weir flume. As the name indicates, the delivery tank, although of uniform section, has been carefully calibrated by weighing the water and noting the rise of level on the float scale. Assuming that the operator by means of the water switch has directed the flow into the weir flume, he next observes the weir flume scale on the float and the manometer reading at the same time, thus checking the weir against the Venturi meter. The float is now closed to the weir tank and opened to the delivery tank. The level of the water in the delivery tank having been observed and, with stop-watch in hand, he throws over the water switch lever, allowing the water to fill up the delivery tank.

The operator allows the pump to discharge into the delivery tank for from say one minute in the case of ten thousand gallons per minute pumps to even half an hour if required for five hundred gallons per minute pumps, and noting the time, switches the discharge from the pump back into the weir flume whence it continues to circulate round. At his leisure, and when the water in the delivery tank is quite still, the operator observes the new level and, subtracting



SECTION-E-F-

FIG. 6. CROSS SECTION OF DELIVERY AND WEIR TANKS.



SECTION-A-B-

FIG. 5. SECTIONS OF WEIR, SUCTION AND DELIVERY TANK, SHOWING SUCTION PIPES AND METERS.

it from the original level, arrives at an exact volumetric measurement of the water passing through the pump. Note here also that the water is still passing through the Venturi meters, thus checking them against the delivery tank. Thus, the Venturi meter checks the weirs, and the volumetric measurement checks the Venturi meter.

For quantities over 10,000 g.p.m. the discharge is delivered direct into the delivery tank through by-pass into the weir flume and over the largest weir which, having been checked up to 10,000 g.p.m. may reasonably be assumed to be exact for larger quantities.

Fig. 7 shows part of the flooring removed with water flowing through the water switch into the weir flume and over the weir.

Fig. 2 shows a closer view of manometer and float, also illustrates the possibility of preparing and setting-up, for test, two pumps at the same time.

There is also a complete electrical testing department, fully equipped for making all tests necessary to determine the performance curves of motors, up to the largest sizes. A Prony brake equipment is also available for testing the smaller sizes. Power is received in the electrical testing department from 3-wire d.c. factory circuit at 220 volts; is then transformed by means of suitable motor generator sets and transformers, and then relayed to the testing table in the pump testing department shown in Fig. 1, where the readings of power input to the machine under test are made. Direct current at 110-220 and 550 volts, and alternating current at all standard voltages and frequencies are available. The power available is 400 h.p. for d.c., and 60-cycle a.c. motors, and 200 h.p. for 25-cycle a.c. motors.

It may also be mentioned that steam inlet and exhaust pipe connections are available at the test plant and small or large steam turbine-driven pumps can be as easily tested as motor or belt-driven units.

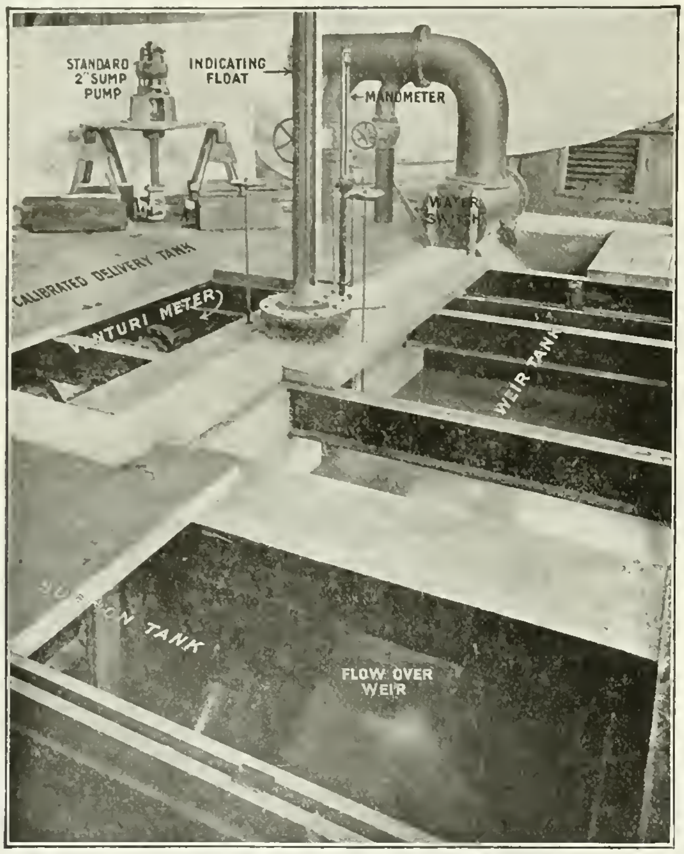


FIG. 7 FLOOR REMOVED, SHOWING WATER TANKS AND WEIR.

"SAFETY FIRST" MOVEMENT IN MONTREAL.

At the present time there is being instituted in the city of Montreal the most comprehensive campaign ever outlined for the prevention of accidents. This plan, made doubly difficult by dual language conditions is being fathered by Mr. A. Gaboury, superintendent of the Montreal Tramways Co., and will embody aggressive operations for at least a year.

Circulars have already been issued to all the automobile owners in the city announcing and elaborating the campaign. Personal letters are to be sent to each of the five thousand cab owners and drivers explaining the plan, and asking his co-operation in the prevention of accidents. These will be followed, as soon as the staff of a dozen men permits, by letters to express drivers, chauffeurs, motormen, conductors and all employees of the Tramways Company. The envelopes will contain, besides a personal letter to the recipient, circular pamphlets setting forth the peculiar dangers which attend traffic on busy streets where cars operate; the possibility of brakes refusing to work, the effects of greasy or wet rails, and many other sources of accident that can be prevented by waiting until the car stops.

All spare space on bill boards and fences on vacant lots will be covered with attractively illustrated posters dilating on the advantages of caution. All trucks, express wagons, street cars and public autos will shortly be decorated with "safety first" signs. Every public school and college and every public office that will accept them will receive large calendars illustrating how accidents occur and how they may be prevented.

During the early part of the campaign, Mr. Gaboury will make a collection of all the moving picture films obtainable which depict accidents, their causes and prevention. These will be supplemented by a number of new ones specially prepared and will be shown in the club quarters of the Tramway employees as well as in the leading moving picture theatres. Special entertainments will be arranged for children who will be admitted on passes issued to the different schools in turn.

A series of weekly meetings for employees of the company will be addressed by the superintendent in the form of short lectures on the prevention of accidents. Instruction, drill and competitions for men in preventive measures will be inaugurated and branches of the St. John Ambulance Society will be established. Each of the men will wear small badges bearing the words "safety first" in both English and French.

Every article of the company's property, transfers, letter heads, notices, trolley sign poles, etc., will bear words of caution, and "Safety First" signs will be offered every other establishment that will accept them. School children will be presented with blotters, rulers, scribblers, etc., which will remind them continually of how accidents are caused.

Mr. Gaboury declares that the scheme is not soon to die a natural death, but that the company will continue to keep in touch with all firms and individuals affected. The circular letters will be repeated at frequent intervals and means adopted to prevent the novelty from wearing off.

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

MAIN SHOES FOR QUEBEC BRIDGE.

THE St. Lawrence Bridge Co., have just completed at their shops at Rockfield, near Montreal, the first of the four main shoes for the new Quebec bridge. Owing to the great length of span and consequent enormous weight of the bridge, these shoes are of extraordinary dimensions.

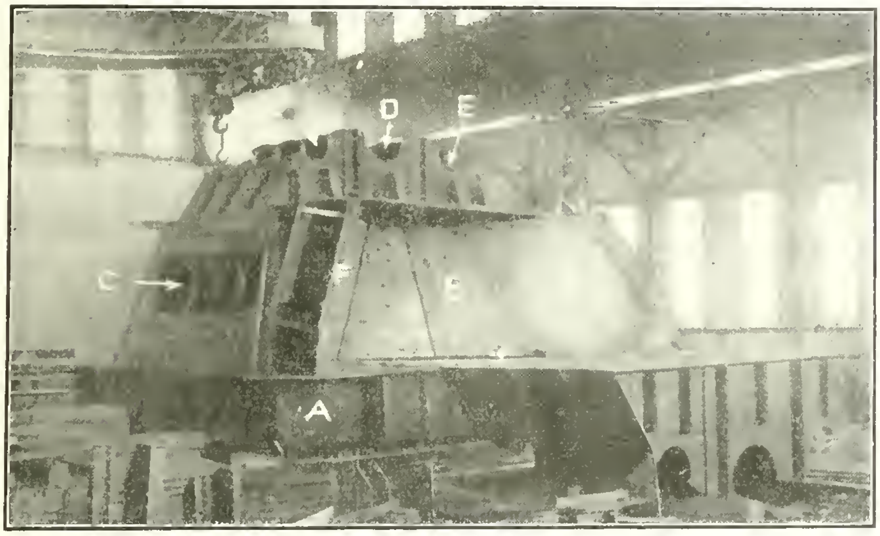


FIG. 1. FIRST OF THE FOUR MAIN SHOES OF THE QUEBEC BRIDGE ASSEMBLED IN THE SHOPS OF THE ST. LAWRENCE BRIDGE CO., MONTREAL, PREVIOUS TO SHIPMENT TO THE BRIDGE SITE. EACH SHOE WEIGHTS ABOUT 450 TONS

The name "shoe" is a convenient short term to indicate the pedestal on which the whole bridge truss rests, and by which the weight is distributed over the granite masonry of the main piers. These piers are accurately leveled off, and on them is built a base or grillage of steel castings. These castings, which may be seem at (A) in Fig. 1, are four feet high. Four of them are bolted together under each shoe, forming a base 26 ft. 4 in. long by 20 ft. 10 in. wide. Each casting weighs rather more than 40 tons.

On top of these castings comes a middle section (B). This is 9 ft. 5 in. high, and consists of four webs built up of steel plates, each web being 8 9-16 inches thick. These are strongly reinforced with angles and are braced to each other by diaphragm plates. At each end is bored a semi-circular hole, 45 inches in diameter, seen at (C). This hole receives a forged bushing or sleeve for a 30-inch pin, through which the bottom chords of the trusses transmit their stresses. This middle section weighs 143 tons, and has consequently to be shipped in two sections. It is split longitudinally and two ribs only are handled at one time. When placed in position at the bridge site, the whole will, of course, be solidly riveted together.

The top portion of the shoe also consists of four webs built up of plates, but is only 5 ft. 5 in. high. It has one 45-inch semi-circular hole (D), at the centre to carry the main vertical post of the bridge, and two 30-inch holes (E) on each side to receive the main compression diagonals. The centre pin is 30 inches in diameter and the side pins 20 inches. Each rib has a side bearing 7⅝ inches wide at the main post and 5⅝ inches wide at each diagonal connection. The top section is handled and shipped as one piece and weighs 58 tons.

The large wing plates (F), seen projecting from the middle section (B), are the connection plates for the lateral bracing which ties the two sides of the bridge together at the bottom. The height of the shoe, including the cast steel base, is just 19 feet. The total weight of the structural steel portions is 280 tons, while the cast steel grillage weighs approximately 170 tons, making a total weight for the complete shoe of about 450 tons. It will be called upon to carry a normal dead load of 18,500 tons, half of which comes in from the main vertical post. The live loads of trains, combined with the effect of a violent storm, may cause this load to be doubled on any shoe, giving a maximum load of 37,000 tons. The position of the shoe in the structure is seen in the picture showing the bridge as it will appear when completed.

The main span has a length of 1,800 feet, while the clear height above high water wark is 150 feet. The main vertical post is 310 feet high and there will be approximately 65,000 tons of steel in the structure, which will rank as one of the heaviest bridges in the world, in addition to having the longest span in existence.

FIG. 2. VIEW OF QUEBEC BRIDGE WHEN COMPLETED SHOWING LOCATION OF MAIN SHOES

SELF-CONTAINED BORING BAR.

By J. P. Sanderson.

WE show herewith, Fig. 1, a useful boring bar that has been thoroughly tried out in a Western shop. The body (B) is made of round stock of the size desired, and preferably of a moderately high carbon material. The ends are slotted with square holes to hold the

tool (T). The one shown is cut on the angle for a bottoming tool. The tool slot at the other end of the bar is best made square, with the bar. The bar is also drilled for the hardened pin (P) and slotted for the hardened taper key (W). The wedge key (W) is kept from falling out and becoming lost by the pin (A) driven through it.

This bar is intended to be used in a cast-iron clamping head for the tool rest, and at least one of the wedges (W) should be made short enough to pass through it. The bar is self-contained. The operator simply tightens or loosens his tool by a tap of the hammer, and no wrench is required.

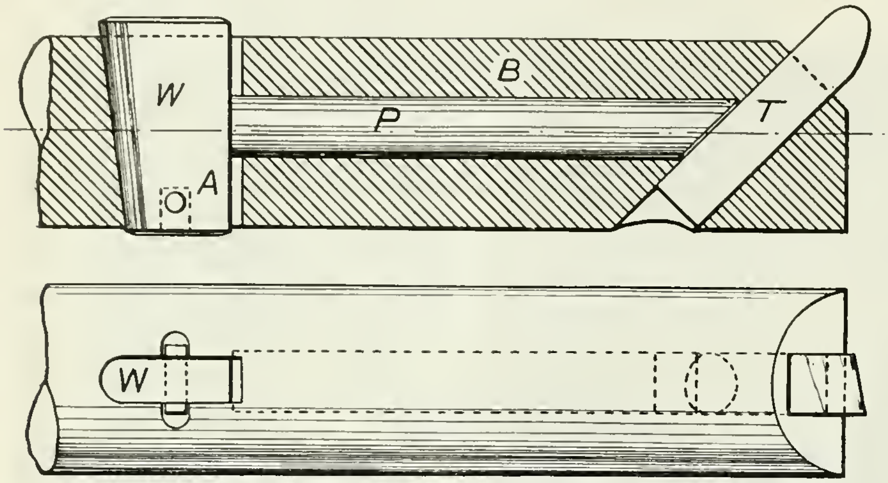


FIG. 1. SELF-CONTAINED BORING BAR.

Cutter for Multiple Boring.

Fig. 2 shows a simple method of making and holding sizing or roughing cutters, being particularly useful where several holes are to be bored in line. The bar (B) may have as many tool slots as there are holes to be bored, while the tools (C) may be quickly changed from roughing to finishing or vice-versa, by tapping out the wedge (K).

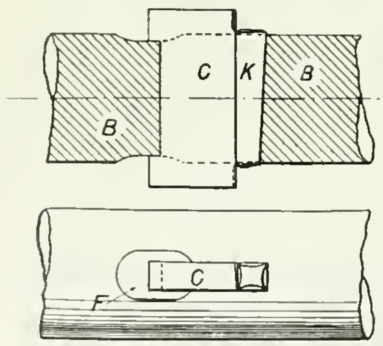


FIG. 2. CUTTER FOR MULTIPLE BORING.

This tool was very successfully applied by grinding the roughing tools to cut on the back or wedge side and the finishing tools to cut on the front or opposite side while rotating in the same direction. In operation, five holes were finished simultaneously in a horizontal boring machine by feeding backwards for the roughing cuts, replacing with finishing cutters and simply reversing the feed.

FLANGE-FORMING TOOL.

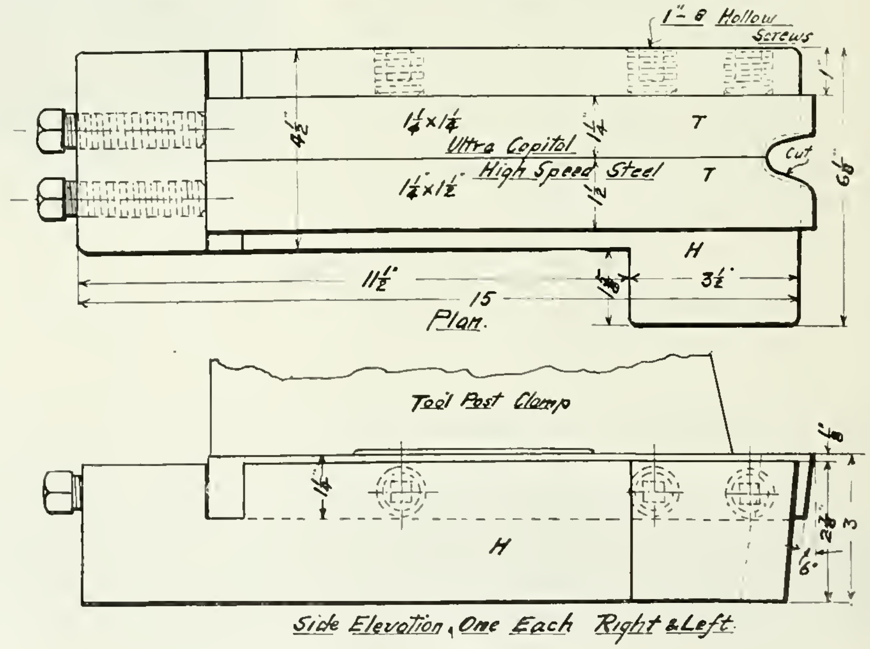
By "Nene."

THE question of flange-forming tools has always been a live issue in railway shops where tires are turned, and particularly where old tires have to be re-turned. Where new work alone is done, the cut and material will, in most cases, have more or less uniformity. This condition does not exist, however, with repair work. The uneven wear of treads necessitates a very uneven depth of cut and, on account of "skidding," the hardness of the material is an exceedingly varying quantity.

This wide range of work conditions, coupled with the standardizing of the time allotted for each operation, requires a tool that is simple in construction, that will be strong enough to meet all conditions, and that can be economically maintained in good order. The writer has witnessed many attempts to fulfil these conditions, and has himself developed the tools herein described. This set of tools has been in constant use for the past six months, and has given the greatest satisfaction of any heretofore tried out.

The holder (H), shown in the figures, is forged from driving axle steel, and is planed to the dimensions given. The tools proper (T T) are made of Ultra Capital high-speed steel, and are ground to shape by hand on an ordinary grinder, in such a way that when the tool-holder is placed in the tool post with its side against the back of same, the tool is in the proper position to form the flange. The offset on the holder is to prevent it from slipping back through the tool post under pressure of the cut, and also aids in adjusting the amount that the tool projects from the holder. The time of setting the tool is thus reduced to a minimum. The hollow set screws are for clamping the tools together only. The tool post clamps bearing directly upon the tools (T T) render any other means of holding them unnecessary. The ⅞-in. set screws at the rear end are for adjusting the tools for repeated grindings.

The practice has been to rough the flange off with the same round-nosed tool as is used in turning the tire tread, and then to finish the flange in one revolution with the formed tool. When the tools become too short to be effectively held by the tool post clamps, they are forged down to suit smaller lathes, and in this way eliminate any waste of expensive steel.



FLANGE-FORMING TOOL.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

Doubtless some of the elementary work in the first few articles of this series may appear more or less superfluous, but it must be remembered that numerous simple rules and formulae appear from time to time in Technical Journals, which are discarded and dubbed impractical by many operators for the simple reason that the elementals are either unknown or have been forgotten. The purpose of this course will have been achieved if the above tendency is even in part combatted.

TRIGONOMETRY.

MATHEMATICS which treats of the solution of triangles is called trigonometry.

Every triangle has six parts—three sides and three angles.

An angle, usually, is the opening between two radii of a circle, the circle being assumed as divided radially into 360 equal parts called degrees; each degree being again divided into 60 minutes, and each minute further divided into 60 seconds. It is evident that a 1° arc in two circles of different radii will be of different length, but will be proportional as the length of the radii. In trigonometry, the arcs of circles are used to measure angles.

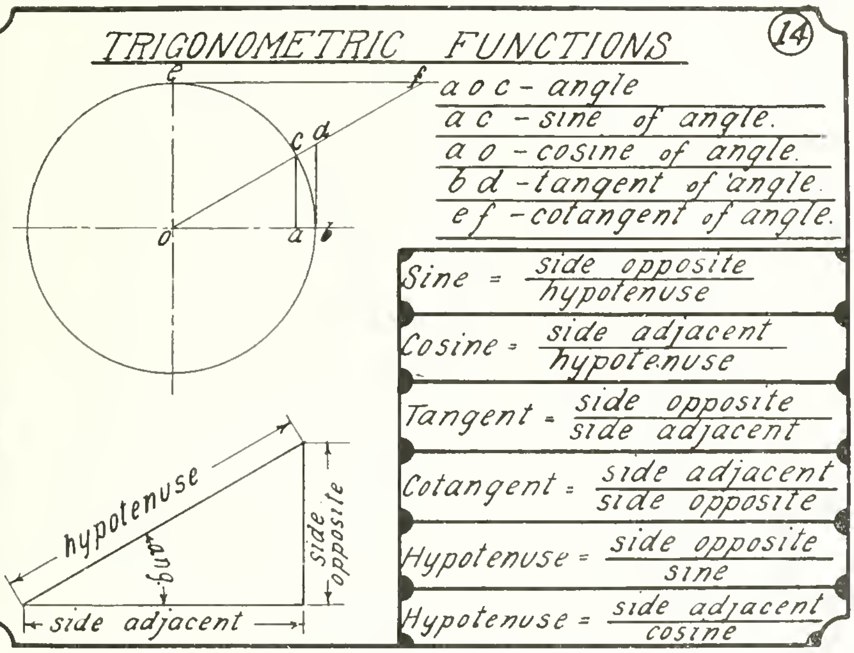
In the solution of right triangles, the base (o b), Chart 14, is generally assumed to be in a horizontal position, the vertex (o) being in the centre of the circle, and the point (b), the starting point in measuring the angle. When adding two or more angles together, seconds are added to seconds, minutes to minutes and degrees to degrees.

Trigonometric Functions.

A function of a quantity is another quantity which depends upon the first one for its value. The principal functions of trigonometry are the sine, cosine, tangent and cotangent.

The sine of an angle is the line (a e) drawn perpendicular to the base (o b), to the extreme end of the hypotenuse, when the hypotenuse is the radius of the circle.

The cosine of an angle is the distance (o a) from the foot of the sine to the centre of the circle or vertex of the angle.



ARITHMETIC CHART 14.

The tangent of an angle is the line (b d) drawn perpendicular to the base to the extreme end of the hpyotenuse, when the base (o b) is the radius of the circle.

The line (e f), drawn from the extreme end of the vertical radius and parallel to the base (o b) to meet the hypotenuse or hypotenuse produced, is called the cotangent of the angle.

If the values of the various functions be known for any angle in a circle whose radius is one, their values for the same angle in any other circle can be obtained by multiplying their known values by the radius of the required circle. Conversely, if the value of any of the functions be known for an angle in a circle whose radius is other than one, the value for the same angle in a circle whose radius is one can be obtained by dividing the known values by the radius of the given circle. Chart 15 gives the values of the four principal functions, in even degrees.

TRIGONOMETRY.

°	sine	cosine	tangent	co-tangent	°
1	·01745	·99985	01746	57·2900	89
2	·03490	·99939	·03492	28·6363	88
3	·05234	·99863	·05241	19·0811	87
4	·06976	·99756	·06993	14·3007	86
5	·08716	99619	08749	11·4301	85
6	·10453	·99452	·10510	9 51436	84
7	·12187	·99255	·12278	8·14435	83
8	·13917	·99027	·14054	7·11537	82
9	·15643	·98769	·15838	6·31375	81
10	·17365	·98481	·17633	5·67128	80
11	·19081	·98163	·19438	5·14455	79
12	·20791	·97815	·21256	4 70463	78
13	·22495	·97437	23087	4 33148	77
14	24192	·97030	·24933	4 01078	76
15	·25882	·96593	·26795	3 73205	75
16	·27564	96126	·28675	3 48741	74
17	·29237	·95630	·30573	3·27085	73
18	·30902	·95106	·32492	3·07768	72
19	·32557	·94552	·34433	2·90421	71
20	·34202	·93969	·36397	2 74748	70
21	35837	93358	·38386	2·60509	69
22	·37461	·92718	·40403	2 47509	68
23	39073	·92050	·42447	2·35585	67
24	·40674	·91355	·44523	2 24604	66
25	42262	·90631	·46631	2·14451	65
26	43837	89879	·48773	2·05030	64
27	·45399	·89101	·50953	1 96261	63
28	·46947	·88295	·53171	1·88073	62
29	·48481	·87462	·55431	1·80405	61
30	·50000	·86603	·57735	1·73205	60
31	51504	85717	60086	1·66428	59
32	·52992	·84805	·62487	1 60033	58
33	·54464	·83867	64941	1·53986	57
34	·55919	·82904	67451	1 48256	56
35	·57358	·81915	70021	1 42815	55
36	58779	80902	·72654	1 37638	54
37	60182	·79364	·75355	1·32704	53
38	61566	78801	·78129	1·27994	52
39	62932	77715	80978	1·23490	51
40	·64279	·76604	83910	1·19175	50
41	65606	·75471	86929	1 15037	49
42	66913	·74314	90040	1·11061	48
43	·68200	73135	93252	1·07237	47
44	69466	71934	96569	1 03553	46
45	70711	·70711	1 0000	1 00000	45
°	cosine	sine	cotangent	tangent	°

a° = angle less m ; a_1° = angle

f = function of a° , f_1 = function of a_1°

d = difference between f and f of $(a^\circ+1)$

d_1 = " " f and f_1

m = minutes

$$a_1^\circ = a^\circ + \left(\frac{d_1}{d} \times 60\right)^{min} \qquad f_1 = f \pm \left(\frac{m}{60} \times d\right) *$$

* If sine or tangent, add the expression, $\left(\frac{m}{60} \times d\right)$.

If cosine or cotangent subtract the expression.

15

ARITHMETIC CHART 15.

The values of 1° to 45° are given in a descending order, and those from 45° to 90° are found by reading from the bottom upwards. Approximate values of fractional degrees are found by the two formulas at the foot of the table.

PREVENTING STEAM BOILER ACCIDENTS.

THE following instructions for boiler operation and repair, taken from the book of rules issued by the Inland Steel Company, should prove of interest to all boiler owners and operators.

1—Two men should always work together when cleaning out boilers, it being the duty of one man to remain on the outside all the time and in a position to see the man working inside so as to give assistance in case it is needed.

2—Never go into a boiler until you have locked the steam valve and closed all other valves.

3—Before entering a boiler, put a torch or candle inside to determine the presence of gas or bad air.

4—In cutting a boiler in and out, use the non-return valves exclusively, in order to insure their proper working. Should the non-return valve fail to work in any instance, notify the foreman immediately.

5—The automatic valves should be examined sufficiently often to insure their prompt action in emergencies, such as the bursting of tubes.

6—When boilers are taken off for cleaning, the main stop valve in the steam connections should be shut off and dependence not put on the automatic quick-closing valves alone.

7—A sign, "Danger, do not move," should be hung on the steam valve of any boiler when it is shut down.

8—Never open a slide or valve when a danger sign is attached and until you have seen that no one is in the boiler.

9—Safety valves should be tested every shift.

10—When opening up any steam line take the following precautions:—(a) Open all available drips; (b) warm the line by opening the by-pass when possible, or by opening the stop valve sufficiently to warm it slowly; (c) never allow an inexperienced man to turn steam into a cold line, unless accompanied by the foreman.

SUN POWER PLANT AT CAIRO, EGYPT.

MR. FRANK SHUMAN, who is chiefly responsible for the design of the sun system of power production, gave in a recent paper before the Manchester Association of Engineers, particulars of the plant erected at Cairo, because that is the nearest place to the tropics easily accessible, though it is not the ideal position for a sun-power plant, being 30 deg. N. The equator would be the ideal position, but up to 20 deg. N. and 20 deg. S. sun power is considered quite satisfactory. In fact, it has been shown that even at Cairo profitable work can be done by sun-power plants.

The experience already gained has demonstrated that low-pressure steam used at atmospheric pressure gives the greatest return in power per dollar outlay. High-pressure steam could be generated by the sun's rays and higher engine efficiencies would result, but the gain would be more than nullified as, on account of the higher temperatures of the boilers, the losses by conduction and convection into the atmosphere would increase. Then, there would be the additional expense of constructing high-pressure boilers.

General Arrangement.

At Cairo, the steam is generated in improved forms of sun-heat absorbers, of which there are five, each 13 ft. 4 in. wide at the top and 204 ft. long. They are approximate parabolic troughs for catching the sun's rays and concentrating them upon the boiler swung at the focal point. These heat absorbers—five in number—are placed about 25 ft. apart in the clear, so that they will not shade each other when the sun is low in the morning and late afternoon. Their axis point north and south and they turn from east to west on their axes to face the sun. The mirrors are set in a light steel frame, each one at the proper angle to throw the sun's rays upon the boiler, and consist of ordinary sheets of third quality window glass 1-16 in. thick, silvered on one side, the silvering being protected from the atmosphere. At the focal point of all the light rays, there hangs a cast iron boiler, which is tubular at the top and flat at the bottom where is located the water space.

This boiler is 15 in. high and is hung on light rods in such manner that expansion and contraction will not affect it. The heat absorbers are a distinct advance upon those in use at Philadelphia. They are set on crescent-shaped frames, which roll on a system of small rollers, while racks and pinions are provided for turning the absorbers from a low eastern aspect in the morning to a low western aspect in the evening, the necessary power being provided by the steam engine and friction clutch, an adaptation of the thermostat being used to throw the clutch in and out of gear. The thermostat is placed immediately below the boiler and remains in the shade as long as the absorber points correctly to the sun. When the sun moves ahead a little and the sunlight strikes the thermostat, the clutch is engaged, and the absorber is turned westward accordingly. When the thermostat is shaded again, the clutch is released and the absorbers stand still, and so on.

The Engine Feature.

The engine is of special design to utilize low-pressure steam to the best advantage, and, according to the author, is extremely efficient, giving one brake horse-power per 22 lb. of steam at atmospheric pressure. It has cylinders 36 in. by 36 in., and gives its power at 110 revolutions per minute. The pump is of the reciprocating type, and a small petrol engine is provided for creating a vacuum in the condenser for starting. At Cairo, the plant commences to make steam at about 7.30 a.m. in midsummer, and the maximum is reached between ten and two o'clock. Then the amount gradually decreases until 5.30 p.m. Tests made show that the average production is 1,100 lb. of steam at 15 lb. absolute pressure per hour for a ten-hours' day. In other words, the plant at Cairo is capable of giving an average of 50 brake horse-power.

The boilers of the present plant are surrounded by a single thickness of window glass in order to minimize the loss by conduction and convection, but in future plants the glass will be dispensed with and the number of concentrators of sunlight increased from five to ten. All the mirrors used in constructing these heat absorbers are held in place by means of small brass springs, to give flexibility and prevent breakage due to expansion and contraction, while a certain amount of resiliency is provided against hailstorms.

Test Data.

As regards the comparative costs of sun-power and coal-burning steam plants, Mr. Shuman said that the steam-producing part of this plant will cost, erected in the tropics, the sum of $7,800, being at the rate of $155 per brake horse power. The boiler, stack, and buildings of a coal-burning plant to generate the same amount of power for ten hours per day throughout the year are estimated to cost $3,850.

According to comparisons made, the sun-power steam generator will compete in the tropics with a coal-burning steam generating plant which can obtain its coal at only $2.50 per ton delivered to the furnace doors. Any excess in the cost of coal burned beyond this figure is clear profit in favor of the sun-power plant, and as the cost of coal in the more favorable places in the tropics where sun-power plants will be built for the present may be taken at no less than $15 per ton, the saving would be some $2,050 per annum, with 365 working days of 10 hours each.

The heat absorbers of the Philadelphia plant had a thermal efficiency of 43 per cent., whereas those in the Cairo plant have an efficiency of 57 per cent., or, in other words, out of every hundred heat units which reach the absorbers, 57 per cent. are turned into steam and used in the engine.

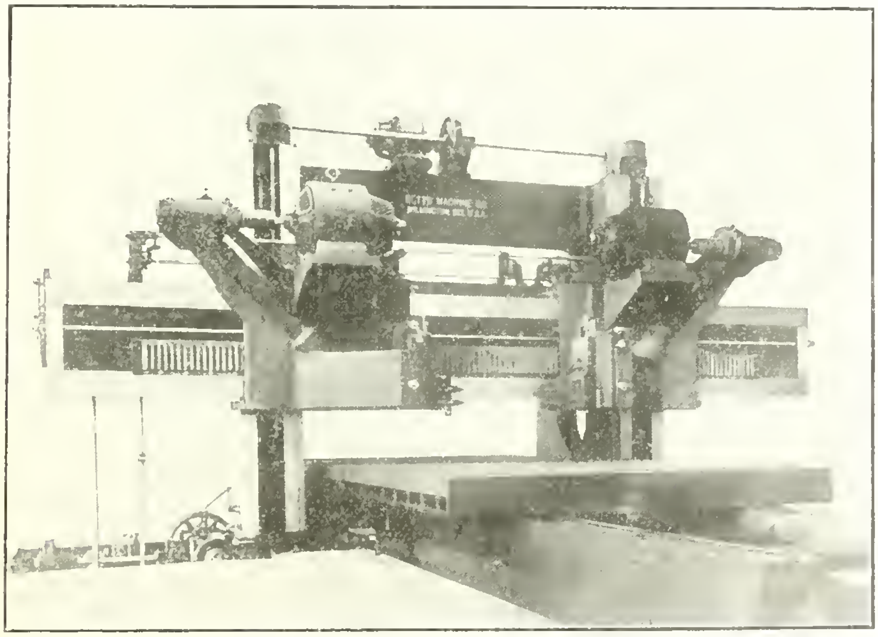
DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

SPECIAL PLANER OF INTERESTING DESIGN.

THE rather curious looking planer shown in the illustration was built by the Betts Machine Co., Wilmington, Del., for the Commonwealth Steel Co., Granite City, Ill., after the latter company's special design; its purpose being to machine the ends of castings running up to 30 feet in length, a proceeding that is impossible with the ordinary type of planer. The cutting tools are arranged so as to move at right angles to the platen, which permits machining the ends of castings of any length as well as other surfaces which cannot be reached with the ordinary planer.

The machine consists essentially of a 10 x 7 x 18 ft. planer of standard construction. The cross rail is, however, special and carries two cutting heads, each of which is driven by a 30 h.p. Westinghouse Electric & Mfg. Co. reversing planer-motor. The two motors are connected together electrically so that if one reaches the end of a stroke before the other, it automatically stops and waits for the other to furnish its stroke, when they both reverse together. To obviate the danger of the heads running together, a push-rod is mounted on one which opens the circuit and stops the motors if pressed.



SPECIAL PLANER OF INTERESTING DESIGN.

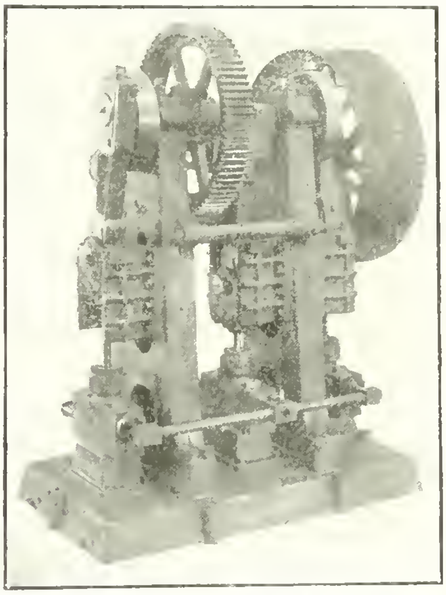
The heads are designed for a cutting speed of 30 ft. per minute, and a return speed of 75 ft. per minute, and are guaranteed to take two ½ x ⅛ inch cuts simultaneously in cast steel.

The platen is provided with a power rapid traverse of 20 ft. per minute as well as a power feed. It is driven by a 7½ h.p. motor of Westinghouse Electric & Mfg. Co. make, while the cross rail is raised and lowered by a similar motor.

VERTICAL TRIPLEX HYDRAULIC PUMPS.

THE accompanying illustration shows a new vertical type of single acting, triplex hydraulic pump as designed and built by the Hydraulic Press Mfg. Co., Mt. Gilead, Ohio. This type of pump is made in three runs of sizes. The J pump has a stroke of 8 ins. and is equipped with plungers ⅞ in. to 3¼ in. in diameter. The JJ pump has a stroke of 12 in. and has plungers 1 in. to 4½ in. in diameter. The JJJ pump has a stroke of 12 in. and has plungers 1¼ to 5 in. in diameter. The range of pressure capacity is from 600 pounds to 16,000 pounds per square inch, depending on the size of the piston. These pumps are driven by either belt or electric motor, the J size requiring 25 h.p. to operate; the JJ 50 h.p.; and the JJJ, 100 h.p. The effective speed of each of three pistons is 33 1-3 ft. per minute for the J pump, and 45 ft. for the JJ and JJJ.

The pumps are fitted with screw glands working against followers when equipped for high-pressure work, or with stud glands when equipped with large pistons for low-pressure work. The pistons are packed with compression packing. Forged steel is used in the con-



VERTICAL TRIPLEX HYDRAULIC PUMP.

struction of the high-pressure pump cylinders and crank shafts. The crossheads are guided and fitted with cast-iron adjusting screws which are bored to provide a perfect guide. The connecting rods are made of open hearth cast steel, and have bronze bearings with wedge and screw adjustment at both ends.

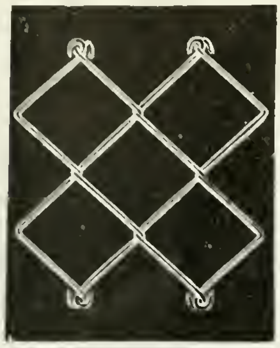
When this pump is operated by a belt, it has a single reduction of gears for the J size, and a double reduction for the JJ and JJJ sizes. The pulleys can be arranged to drive from either end. When a motor is used to operate, it has a double reduction of gears for all sizes. The first reduction has a ratio of 5 to 1, while the second reduction depends on the speed of the motor used. The height of the J pump is 5 ft. 9 in.; the JJ, 8 ft. 1½ in., and the JJJ, 8 ft. 10 in.

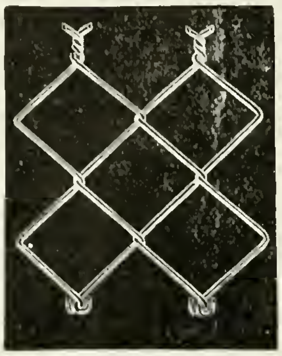
A NEW EUROPEAN WIRE FENCE MACHINE.

IN view of the increasing demand for wire fencing in this country, a description of a new wire netting fence machine built by Otto Schmid, Feuerbach-Stuttgart, Germany, is not unseasonable. One of the chief advantages

claimed for this machine is that it handles galvanized wire successfully and thus eliminates the necessity of a galvanizing plant to finish the product. Simplicity of design and operation and the comparative lack of skilled help required for operation are also strong points set forth in its favor.

The machine occupies a floor space of about 16 ft. 6 ins., by 9 ft., and is about 5 ft. high over all. It can be set with the aid of certain attachments to produce meshes of various sizes from 1¼ in. to 4 ins. square, and the rate of production per ten-hour day is from 3,300 to 4,400 sq. ft. for the smallest mesh and from 7,800 to 8,900 sq. ft. for netting of 4 in. mesh, according to the gauge of the wire employed. The width of the piece can be made to range from 2 ft. 8 ins. to 6 ft. 6 ins., and the wire is the ordinary mild steel wire of commerce and, as before stated, is already galvanized.


Bent over on both sides.


Barbs twisted on top, wires bent over below.


Both sides with tension or edge wires.


One side with tension or edge wire, the other with edge wire and barbs.

EXAMPLES OF NETTING—1½ IN. TO 4 IN. MESH, WIRE GAUGE 2-32 IN. TO 5-32 IN.

The netting is made complete with edges in one operation. The wire to form the meshes is drawn from a wire swift placed on the floor, while the wire to finish the edges is drawn from two swifts, one placed at each end of the machine. The machine may be arranged to produce edges of four different kinds, viz.:

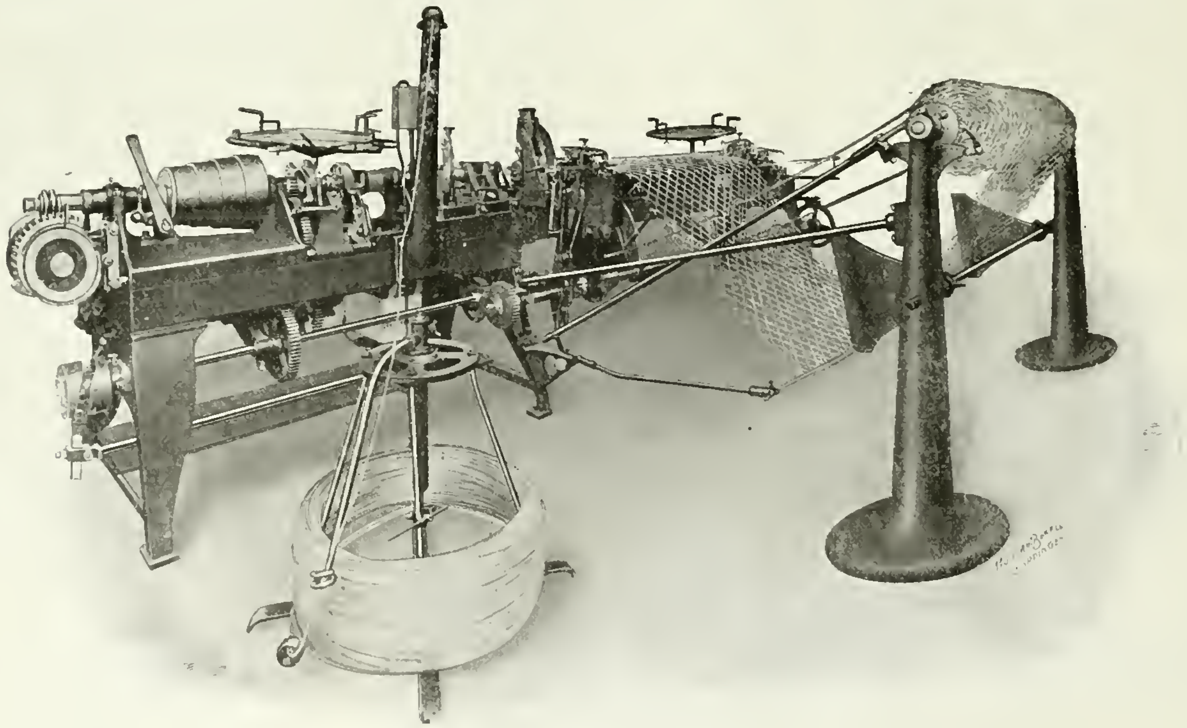
(1) With the ends of the wires which form the meshes bent over on both edges.

(2) With barbs twisted on the upper edge and the wires bent over on the bottom edge.

(3) With plain or two stranded edging wires on both edges of the netting and the ends of the mesh wires bent over plain.

(4) With edging wires in both edges and the mesh wires twisted into barbs on one edge and twisted over plain on the other. These different styles of finish at the edges are produced automatically and simultaneously with the making of the meshes, and as the netting is completed, it is wound up into rolls of convenient size.

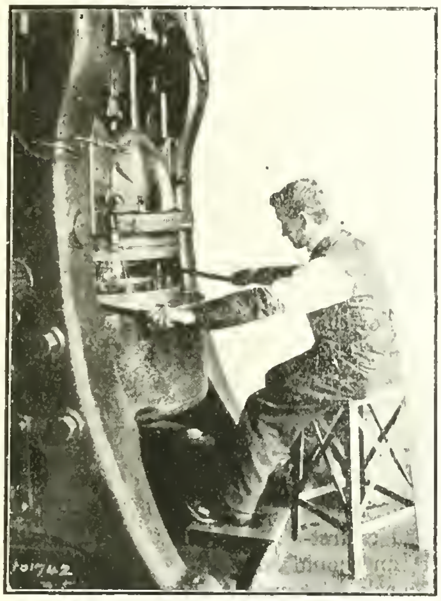
The power required to operate is derived from a two-h.p. electric motor, and the machine is automatic to such an extent that one man can easily operate two machines. The fencing is produced without undue strain being placed on the wires so that the netting is suited for concrete reinforcement and other uses as well as for fencing.


AUTOMATIC WIRE NETTING MACHINE.

Edward Brand & Co., 96 Victoria street, Westminster, London, S.W., Eng. are colonial agents and distributers for the above described machine.

SAFETY SUCTION DEVICE FOR PUNCH PRESSES.

FOR some time the Westinghouse Electric & Mfg. Co., at East Pittsburg, tried mechanical safety devices of various kinds for the punch shop but with unsatisfactory results. The operators found them unsuited because of the fact that they tended to retard the production and consequently their earnings, while the management also objected to them because they afforded only partial protection, as the operator had to place his hand under the press in every instance, in order to remove the scrap. The suction device illustrated herewith was developed with the idea of preventing the necessity of the operator approaching the danger point at any time during the operation, as he feeds and clears the press with the same tool.



SAFETY SUCTION DEVICE FOR PUNCH PRESSES.

Another advantageous point is that the operator does not take hold of the material with his hands (this applies principally to the smaller sizes), and thereby escapes the numerous small cuts to which he was subjected when inserting the blanks with his fingers. The double-handle device used on large work and shown in the illustration is absolutely safe, the operator being compelled to use the device owing to the size of the sheets handled, it being impossible to get hold of them any other way. Before adopting this method, a man was placed at the back of the press to feed in the sheets, and he was the man who most frequently was injured because his fingers were entirely at the mercy of the operator.

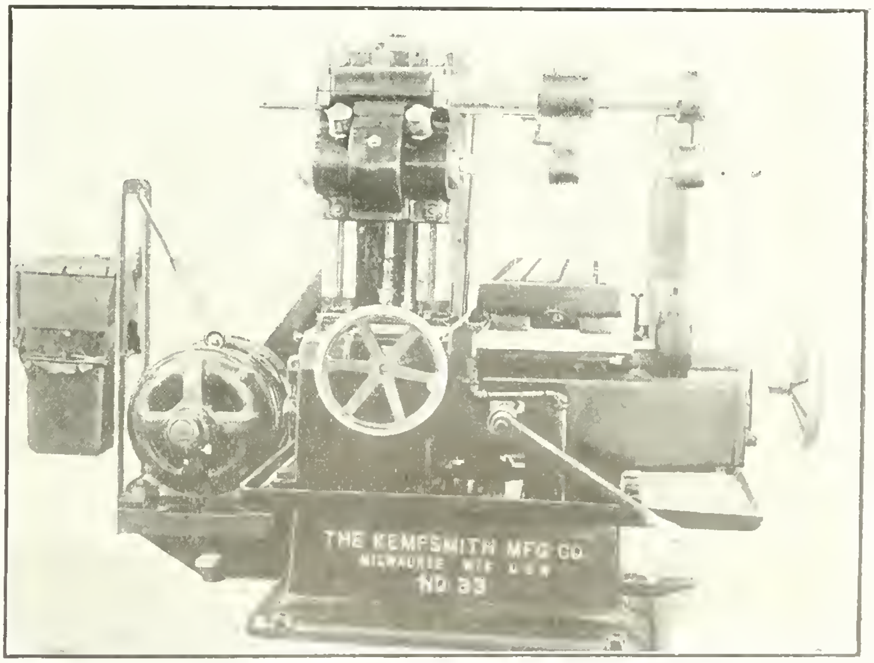
Since the adoption of the suction device, there has not been an amputation on the large presses and up to the present time no finger has been amputated in the punch shop. This freedom has been due to the operation of the device and the rigid enforcement of the rules by the management of the shop.

The suction device was exhibited and received the grand prize at the recent International Exposition of Safety and Sanitation in New York City, and is now on exhibition in the American Museum of Safety in New York City. The Westinghouse Electric & Mfg. Co. also employ a number of other safety appliances such as magnetic lifters, sliding devices, etc., adapted for the different kinds of punchings made.

MULTI-SPEED MILLING MACHINE FOR CONSTANT SPEED MOTOR DRIVE.

THE milling machine illustrated herewith, which is the product of the Kempsmith Mfg. Co., Milwaukee, Wis., is designed to give a number of spindle speeds with constant speed motor drive and hence is admirably adapted for use with squirrel-cage alternating-current motors. A range of spindle speeds from 25 to 120 r.p.m., is provided, with a different gear ratio, ranging from $2\frac{1}{2}$; 1, to $11\frac{1}{2}$; 1, for each speed. The machine can, therefore, take the stiffest cuts with higher speed cutters. All speed changes are effected through change and sliding gears; there being no loose gears.

The machine is massively constructed throughout and is adapted for heavy manufacturing service. Every lever and wheel is located within the operator's reach so that very rapid production is possible. The longitudinal table feed is 36 inches; the vertical adjustment of the spindle, 10 inches; the working surface of the table, 42 by 13 inches, and the total distance between housings, $26\frac{3}{4}$ inches. Power is supplied by a Westinghouse Electric & Mfg. Co. alternating current squirrel-cage motor.



MULTI-SPEED MILLING MACHINE FOR CONSTANT SPEED MOTOR DRIVE.

CANADIAN PATENTS.

PIGEON, PIGEON & DAVIS, patent solicitors, St. James Street, Montreal, report that 136 patents were issued in Canada on March 24, 1914. Of these patents 87 were issued to residents of the United States, 29 to Canadians and the balance to residents of foreign countries. The following is a partial list of the patents granted to Canadians:

A. K. Mitchell, Victoria, B.C., Flue Joints.

J. P. Linton, Montreal, Que., Mail Chutes.

J. E. Bennett, Toronto, Ont., Furnaces.

R. W. Burnett, Montreal, Que., Dump Car Doors.

X. Longtin, St. Johns, Que., Air Valves.

J. Rundgren, Vancouver, B.C., Fish Plates.

H. P. Borden, Montreal, Que., Bridge Construction.

W. R. F. Patchett and H. Pilling, Lethbridge, Alta., Internal Combustion Engines.

P. Barton, Calgary, Alta., Hose Coupling.

A. Bue, Calgary, Alta., Water Power Apparatus.

W. S. Dignam, Toronto, Ont., Vacuum Washers.

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Vol. XI. APRIL 23, 1914 No. 17

PRINCIPAL CONTENTS.

FACTORY ACT AMENDMENT.

AN amendment to the Factory Act in the Province of Ontario seeks to include men who operate hoisting engines within the scope of the requirement of a stationary engineer's operating license. The term "hoisting engines" is rather vague and seems to imply a complete absence of both knowledge and purpose on the part of those responsible for this projected addition to the statutes. Hoisting engines embrace a particularly wide field, some sections of which are on a par with many of our power plant units, and are no doubt considered, at least, as such by their owners in the matter of licensed competency.

We presume, however, that it is now sought to include, crane equipment, steam shovels, concrete mixers, etc. If this be the case, a levelling down process so far as the operative is concerned appears to be the result, and unless some concurrent legislation which will discriminate between man and man, and reward higher intelligence and capacity attainment, we fear that little real benefit to anybody will ensue from the present action.

THE VALUE OF A FOREMAN.

UPON a recent visit to the machine shop of a well-known firm, we were required to wait a considerable time for the foreman. When, at last he appeared, it was with a twenty-pound casting in one hand and the other one too grimy to offer his visitors. After wiping off the perspiration it was necessary for us to spend twenty minutes seeking the information desired of him, and which, when obtained, was more or less unsatisfactory.

A foreman, in the eyes of the veriest layman, is a man who has proved his efficiency in skilled and unskilled labor to such an extent as to be a suitable person to act as a director of his apportioned work. If this directing be thoroughly and properly done, the foreman, no matter how active he may be, will have little time to devote to the work of his subordinates.

It is an extremely thoughtless and short-sighted policy of a management to load a first-class mechanic and disciplinarian, as the foreman should be with a quantity of clerical and laborious work. There are many foremen who are required to spend one half of their time at the tasks of cost clerks, draughtsmen and even errand boys. In the great majority of cases, however, this condition is brought about by the carelessness of the foreman himself. There are, of course, many instances where it is less trouble to do a job oneself than to explain its ins and outs to others, but this is often due to the fact that the foreman is not practised in doing the latter.

The cost of a mechanic is considerably less than that of his foreman; that of a clerk should be about one-half, and that of a boy about one sixth. If he does the work usually allotted to any or all of these classes of men, particularly if it be to the slightest disadvantage of his own work, the manager is inclined in nearly every case to place him in a lower class and remunerate him accordingly.

A period of vigorous self-government upon his own part in adhering to the policy of delegating these tasks to the proper persons will cause the foreman to find a wonderfully large number of other ways in which he can be useful to his firm. He can study the temperament of each man and govern him accordingly. He will find that he can think of several things at once and that his forethought will make unnecessary many of the fatiguing tasks which he previously allotted to himself. He will be prepared for emergencies which, though they do not come often, if taken by the forelock can be turned to great benefit to the institution. A physically tired man has not the nerve force necessary to govern workmen to the best advantage or to retain their greatest respect. The admiration of a man is seldom gained by doing something that he can do just as well himself, or something that he considers beneath his own dignity. The reformed foreman will find it much to his advantage to cultivate those attributes which he considers essential to the men above him. Keen perception of possible economies, promptness in dealing with exigencies, firmness and fairness in discipline, and alertness in dealing with the manager himself are much more likely to favorably impress that official than a personal exhibition of mechanical ability.

INDUSTRIAL NOTABILITIES--No. 31

BERNARD WILLIAM PALIN COGHLIN, president of B. J. Coghlin Co., Ltd., was born February 10, 1874, at Montreal, Que. He is a son of Bernard James Coghlin, of Irish birth, a prominent manufacturer, and Lucy Alice Palin Coghlin, who was of English birth.

B. W. P. Coghlin was educated in the public schools of Montreal, and in 1891 commenced his business career, entering his father's employ as clerk and working his way up in the various branches of the business, learning it in all its details.

In 1905 he was admitted to the firm as partner, and upon the death of his father, in 1909, he turned the business into a limited liability corporation under the firm name of B. J. Coghlin Company, Ltd., manufacturers of railway sup-

BERNARD W. P. COGHLIN.

plies, etc., with an extensive manufacturing plant at Montreal. Mr. Coghlin is president and managing director.

He is a member of the Montreal Club, Montreal Jockey Club, Montreal Amateur Athletic Association, Montreal Curling Club, Outremont Golf Club, Kanawaki Golf Club, the Winter Club, Canadian Club, Montreal Board of Trade, Canadian Manufacturers' Association, Montreal Art Association, and is a Governor of the Montreal General Hospital.

Mr. Coghlin was married October 28, 1903, to Louise Jean Dawes, daughter of the late James P. Dawes.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 65
Lake Superior, charcoal, Chicago		16 00
Ferro Nickel pig iron (Soo)		25 00
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	19 00	18 35
Victoria, No. 2X.......	18 75	18 10
Victoria No. 2 Plain...	18 50	17 85

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.05
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAILS AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb. off
Nuts, Hexagon, all sizes..	4½ per lb. off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright	85, 10, 7½, 10, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ...	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21. 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 75	$15 75
Electrolytic copper	15 50	15 25
Casting copper	15 00	15 00
Spelter	5 25	5 25
Tin	39 50	41 00
Lead	4 85	5 30
Antimony	8 50	[illegible] 50
Aluminum	20 00	19 00

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4.50	4.40
Queen's Head, 28 B.W.G.	4.40	4.65
Fleur-de-Lis, 28 B.W.G.	4.20	4.45
Gorbal's Best, No. 28	4.40	4.65
Viking metal, No. 28	4.20	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal	0.22
Pure turpentine	0.69
Linseed oil, raw	0.61
Linseed oil, boiled	0.64
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

OUTLOOK STILL TOWARDS DULLNESS.

RECENT events have not been at all reassuring as far as the business outlook is concerned. Weakness in the shares of steel companies can only be interpreted as indicative of further industrial dullness. The favorable tariff changes were not sufficient to offset price declines, and the lack of a decision relative to the C.N.R. aid accentuates and encourages the prevailing pessimistic tendency. Not until that is finally disposed of will business settle down to a more normal basis. Meanwhile the ordinary business of the country seems to be moving along at a pace considerably under that of a year ago. Some acceleration has been felt as the result of spring weather and spring conditions.

Some Hopeful Signs.

It may be as well to note here that our principal cities are looking forward to development of an exceptional character during the coming summer. At Toronto the harbor improvement and new railway terminus will be proceeded with; at Montreal the railways are under the necessity of incurring immediately expenditures on a large scale; and at Winnipeg a big scheme to provide the city with a supply of soft water will be under way, and building there has already assumed proportions quite as large as those of the previous year. Up to the 10th of April the building permits were $700,000 greater than for the previous year. At Vancouver the several railroad corporations with terminals there will during the coming year carry on work which will cause much money to be circulated in that city. At other important cities, both in Eastern and Western Canada, there will be expenditures which may be reasonably termed somewhat exceptional. For the carrying out of the contemplated improvements the financing has to a very large extent been done.

Our cities therefore have not any reason to look upon the coming summer months with any degree of gloom. In so far as the agricultural classes are concerned, they are still enjoying very high prices for their products, that is, those who have given attention to mixed farming. Seeding operations have already started, and the next few weeks will be watched with keen interest as they have in them a very important factor in shaping the trend of business. The temperature in the West has been steadily improving as indicated by official returns.

Wage Reductions Probable.

It is quite probable that within the next few months there will be a re-adjustment of wage schedules in Canada. Already the steel men in the United States are considering taking some action in this respect. It is quite apparent that capital for the next year or so will have its innings. It will not be in the position of having to pay high wages for necessary labor in order to get it, but will be in a position to bargain.

Montreal, Que., April 20, 1914.—The general opinion indicates a slight improvement in most lines during the past week, though the metal market remains quiet. Machinery brokers in particular report an improved state of affairs, which is the more gratifying, as nobody has been worse hit than they by the hard times we have been passing through. Two important machinery orders have just been placed. One of these is for the equipment in connection with the Prince Rupert dry dock of the G. T. P. Railway. This is the most valuable contract placed during the past six months, and amounted to over $100,000. The whole of this large order is understood to have been divided between the John Bertram & Sons, Co. and the Niles-Bement-Pond Co. It is satisfactory to know that this matter has now been settled, it having hung fire for some considerable time; in fact, tenders were submitted in December last.

The other contract referred to as being placed this week is that for the machinery to be installed in the new Longueuil plant of Armstrong, Whitworth of Canada, Ltd. This order has been split up amongst the leading Montreal dealers, Williams & Wilson and the Canadian Fairbanks-Morse Co. getting a good share of the business.

It is interesting to note that some pretty good judges of financial conditions are expressing the opinion that the stock market has fallen about as low as it will do, and that better times may shortly be expected. Other well-known business men, on the other hand, see little prospect of a resumption of normal conditions before next fall. The dull state of the building trade during the past nine months is reflected in the annual report of the National Brick Company for the year ending February 28, 1914. This shows a striking decline both in gross and net earnings, the latter marking a reduction of more than 46 per cent., as compared with the previous twelve months.

Toronto, Ont., April 21, 1914.—The business outlook cannot be said to be any more favorable than was reported last week. While the tariff changes will eventually have a favorable effect upon the operations of the steel companies, it is too early to expect any definite improvement as this will only become pronounced when the money market becomes easier and the demand for material correspondingly greater. The trouble between the United States and Mexico, as was to be expected, has had the effect of depressing the money market, although it has been to some extent already discounted. The effect, however, will be sufficiently great to postpone, until a settlement is finally reached, any permanent improvement. The railroad situation remains the same, no decision relative to the C.N.R. having, as yet, been handed down by the Dominion Government. It is reasonable to suppose that when the matter is settled and if favorable, as is generally expected,

that it will mean the purchase of a large amount of material for improvements, extensions and equipment. The Canadian Kodak Co., have called tenders for their new reinforced concrete factory at Mount Dennis, Ont., but no awards have been made up to the present.

The outlook in the steel industry does not improve, and it is difficult to say when a reaction will take place. Prices on structural shapes are being maintained and it is thought that there will not be any reduction. The demand has not increased to any appreciable extent, as might reasonably have been expected with the return of more favorable weather conditions for building operations. An improvement in this respect should be in evidence in the near future, although no large buildings requiring steel are apparently being projected. The steel companies in the United States are operating at considerably reduced capacity, and the question of reducing wages is still being discussed. Some mills are running on short time.

No change can be reported in the pig iron market, a condition of dullness with firmer prices still continuing. Shipments are generally in light tannages, consumers only buying to cover immediate requirements.

The machine tool business, although quiet, seems to be looking brighter. Local dealers report a larger volume of inquiries of a more substantial nature than during the past few weeks. Orders are, as a rule, only being booked for single machines, buyers apparently waiting for a return of good trade before preparing larger specifications.

The metal market is, if anything, rather brighter, and prices keep firm. Buyers appear to still be in a cautious mood, and consequently the volume of business being done is not large, although conditions are improving gradually.

Ottawa, Ont., April 20, 1914.—Tenders were called during the past week for the new Government-owned interior storage elevator at Calgary. The new elevator will have a capacity of two and a half million bushels, and the estimated cost runs from one to one and a half million dollars. Plans and specifications of the new elevator can be secured from the chief engineer of the grain commission, whose office at present is in Saskatoon. The new elevator will be modeled after those now at Moose Jaw and Saskatoon. Tenders are to be in by June 1.

Engineer Howe of the Grain Commission who has over-sight of the construction of the new elevators was in Ottawa during the week consulting with the Government in regard to the new Calgary elevator. He states that splendid progress is being made on both the Saskatchewan elevators and that they will be ready for operation by December 1, which is the time when they become useful from a transportation standpoint.

An exceptionally large Government contract was let by the Cabinet on Saturday, being that for the construction of a big jetty wall nearly four miles in length at the mouth of the Fraser River, and for the necessary dredging to make a channel three hundred feet wide and ten feet deep at low water. The successful tenderer was the Pacific Dredging Co., their price being $755,993.

The end of the session at Ottawa is in sight now and another week will see the beginning of morning sessions. The only important measures left as far as the business world is concerned are the Trust and Loan Companies Act and the New Consolidated Railway Act. The Trust and Loan Company Acts have already been pretty well threshed out by the banking and commerce committee and are ready for the House. The discussion in the House should not be long.

As for the Railway Act, the railway companies, it is understood, are making preparations to make vigorous objections to certain sections, particularly to those clauses which place the complete control of capitalization in the hands of the Railway Commission. In fact, they generally object to the increase in the power given the Railway Board. One high railway official complained that the railway presidents were only messenger boys for the Railway Board.

From the standpoint of shippers, one of the most important features is the proposed changes in the law which will place the control of all water freight rates as well as railway rates under the control of the Commission.

Winnipeg, Man., April 18, 1914.—While building permits in the city of Winnipeg have passed the four million dollar mark, and the figure is going up at an unprecedented rate, business all round does not show the improvement one would expect. There is considerable talk of what the railways will do, but so far few contracts have been awarded. Yesterday, the contract for the Weyburn-Lethbridge route on the C.P.R. was awarded, which will mean business further West, and the impression is that if any railway work be done this year, it will be much farther West than Winnipeg.

In the machine tool market, a cloud seems to have fallen again, and the inquiries from machine shops of a month ago have ceased somewhat. At Transcona, Man., where the G.T.P. shops are located, things are beginning to hum. They have 1,200 men working altogether in the repair and car shops, and repairs to engines, cars and coaches are keeping them very busy. They have recently installed a considerable quantity of machinery in the new car repair shops, the departments of which consist of woodworking, car wheel repair, and painting departments. While they are not manufacturing new cars, it is understood that they now have the facilities for so doing as soon as conditions warrant it.

An important industry is about to open up at Selkirk, Man., in the Manitoba Rolling Mills, and our information is that they will probably be ready for operation some time next month. They are located about a mile and a half south of the town of Selkirk.

A large amount of engineering work is being done on grain elevators throughout the West, which keeps firms like the Vulcan Iron Works and the Manitoba Bridge & Iron Works fairly busy. Lumber firms, several of whom were reported to be contemplating erecting new mills throughout the West, are reported to be waiting until business improves appreciably. Contractors are not buying.

The St. Boniface and Motor Co. Ltd., were incorporated here last week with $75,000 capital, and should be erecting a garage and machine shop. Development work has started on the new Winnipeg power plant on the Winnipeg River at Grand Bonnet Falls. The engineers, J. G. White & Co., New York, are figuring on three alternative plans for building the dam and plant

THE WESTERN FREIGHT RATES JUDGMENT.

THERE has been and still is some controversy as to the effect of the decision on earnings. That these will show a considerable falling off is only to be expected, "but," says one authority, "it may be doubted if any decline in the stock is actually justifiable, nevertheless."

This statement is made in view of the fact that, although the commission granted a reduction in freight rates in the West, a deaf ear was turned to the main contention of the West that the lower rates in the East constituted a discrimination against the West. The commission declared that this was not the case. It supported the railways in the main contention, but it ordered rate decreases, especially in Saskatchewan and Alberta.

"The rates in these Provinces were ordered to be pulled down to a level of those of Manitoba. Other reductions, also, were ordered.

Reduction Coming Anyway.

"It is hinted in some quarters, however, that it was only a matter of time until these rates would have had to come down anyway. In fact, some declare that the C.P.R. would voluntarily have reduced the rates very shortly, as soon as the C.N.R. and the G.T.P. became full-

fledged transcontinental railways entering fully into competition with it. Assuming that this were the case, the railways actually lose nothing worth speaking of as a result of the decision of the commission.

"On the other hand they have gained much, as they are no longer threatened with the possibility of having to pull down their Western rates to a level of the East. Moreover, it seems likely that it will be a long time before they will again be subjected to such a gruelling as they were in the recent investigation. A principle in railway rate-making has now been established that will make for the stability which is so much desired by the commercial world."

Benefit of Through Freight.

Incidentally, it may be interesting to quote from the decisions of the Railway Board their comment on the effect of the construction and operation of the Canadian Northern and the Grand Trunk Pacific upon the earnings of the Canadian Pacific:

"Perhaps the main reason why the results of the Canadian Pacific are so much more favorable than the returns of the Canadian Northern and of the Grand Trunk Pacific is that the Canadian Pacific gets the benefit of through freight both east and west of the Prairie Provinces. That company enjoys the through haul not only of its own business, but also on the business of the other systems in so far as their through business is carried in Canada. The Grand Trunk hopes to have its through connections some time during the present year, while the Canadian Northern should finish the construction of its main line certainly some time the year after.

"The railway situation would then be entirely changed. The monopolistic advantages of the Canadian Pacific will disappear. The through business to a greater or less extent, will be divided among the three lines. There will be three sets of overhead expenses to which the through traffic will be subject, and it is very doubtful that the natural increase of the country's business will recoup the Canadian Pacific, at least for some time, for the losses of business that line will experience not only by the completion of the other two systems, but in view of the fact that the Canadian Pacific has, during the period under observation, earned large sums of money in respect of traffic which must entirely cease; that is, the revenue that it has obtained in handling the materials, supplies, and men that the building of the other two lines has required."

MAY HASTEN CONSTRUCTION OF STEEL PLANT.

THERE is every reason to believe that one effect of the action of the Canadian Government in putting a tariff of $3.50 a ton on wire rods, will be to cause the management of the United States Steel Corporation to hasten the construction of the company's proposed new plant at Ojibway, Canada.

The corporation is a large exporter of wire rods to the Dominion and the tariff will of course, militate against it, although a considerable portion of the rods sent to Canada are of special specification which the mills in the Dominion are not able to supply, and it may be presumed that even with the tariff handicap the Corporation will still be able to get orders for these.

The site for the new plant has already been laid out and in view of the tariff development, it is understood that the Corporation will carry out its original intention to break ground for the actual work of building this spring.

STEEL OUTLOOK DEPRESSING.

MUCH pessimism appears to be current regarding the Canadian steel industry and the earnings of the Canadian steel companies, and the stocks of the various Canadian corporations are all lower. This state of affairs appears to be a replica of the situation in the United States, where the Steel Trust shares have been under pressure, where low prices for steel are quoted, and where very dismal estimates of earnings are current. The fact seems to be that on both sides of the line there is a scarcity of orders for steel products.

Building operations are not anything like as active this year as they were last spring, and the steel mills, the cement companies, and similar concerns, which supply building material of various kinds, are suffering. Only a short time ago the Canadian steel stocks were quite buoyant in expectation of the tariff concessions, which they expected. They secured the concessions but the buoyancy is all gone. No amount of protection, it would seem, is of avail unless customers are willing to buy.

HANDLING EIFFCIENCY.

THE general adoption of overhead runways in the foundry has been considerably retarded by the use in many instances of unsuitable, or only partly suitable equipment. There is being marketed a traveling chain-block which is specially designed for handling molten metal, a particularly interesting feature being the arrangement by which the hand-chain is carried away from the ladle so as to keep it cool, and at the same time prevent it from accidentally falling into the hot metal. It may be noted too that the lifting gear is built up into the trolley. This makes a very rigid construction, gives a high lift and tends to keep the gearing away from the heat. The traveling wheels are fitted with ball-bearings to permit of a high speed of operation, and this is also aided by the construction of the junctions which, containing no moving parts, require no time to operate them.

The Herbert Morris Crane & Hoist Co., Toronto, have put the above equipment on the market.

Trade Gossip

Victoria, B.C.—The contract for the 84-horse-power motor hose wagon to be secured for the fire department will be awarded to the Nott Fire Engine Co. of Minneapolis, at a figure of $7,000. The apparatus will be of the six-cylinder combination type. The Canadian Consolidated Rubber Co. will supply 1,500 feet of 2½ in. fire hose at $1.10 per foot, and an equal quantity will be purchased from the Gutta Percha & Rubber Co., at a similar figure.

Victoria, B.C.—The contract for the construction of the steel riveted pressure pipe line for the Sooke water works system, to connect the Humpback reservoir, was awarded on April 6, by the city council to the Burrard Engineering Co. of Vancouver. The price was $324,000. This bid was the lowest of six recently received. The other bidders were Hutchinson Bros., of Victoria, $342,000; F. V. Robertson, $365,750; Moore & Pethick, $380,000; Victoria Machinery Co., $384,036; Canadian Northwest Steel Co., $423,250. Offset against this price is steel plate to the value of $157,000, now in possession of the city. This is paid for, and must be used by the contractor.

The General Supply Co., Winnipeg, have secured the agency in Manitoba and Saskatchewan for the Cincinnati Milling Machine Co., and the Cincinnati Bickford Machine Tool Co., Cincinnati. They have also been appointed agents of the Bradford Machine Tool Co., Cincinnati, for the whole of Canada. Other agencies secured are:—G. W. Parsons, Newton, Iowa, makers of the Parsons trench excavating machinery, and that of the Foos Gas Engine Co., Springfield, Ill. Already orders for 25 of the latter firm's 12 h.p. engines have been secured for service in Saskatchewan elevators around Regina. The above company has also the Western agency for the Smart Turner Machine Co., Hamilton, Ont., makers of steam pumps.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Toronto, Ont.—The Canada Metal Co. will build an addition to their factory.

Lucknow, Ont.—The Imperial Bag Holder & Machine Co. will extend their machine shop and install new equipment.

Montreal, Que.—The Simonds Canada Saw Co. will build an extension to their factory. C. E. Deakin, Ltd., has secured the contract.

Edmonton, Alta.—The City Commissioners have decided to build a pumping station at South Edmonton at an estimated cost of $50,000.

Medicine Hat, Alta.—George Sillman is establishing a factory at Dunmore for the manufacture of steel bins. The factory will open in a few days.

Saskatoon, Sask.—Fire destroyed the premises of the John East Foundry Co. recently. The loss is estimated at $5,000, which is covered by insurance.

Toronto, Ont.—A fire which occurred in the Morrison Brass Works, 93 Adelaide street west, caused damage to the extent of $550 last Tuesday.

Englehart, Ont.—The Charlton Englehart Power Co. will have their new plant fully installed and ready for furnishing power by May 1. The plant consists of practically three units.

Chatham, Ont.—C. S. Cornelius, of the Canadian Wolverine Co., whose plant was destroyed by fire on April 10, states that the work of re-construction will start as soon as possible.

Port Hope, Ont.—J. E. Murphy, president of the International Tool Steel Co., has been here conferring with the Harbor Board with regard to establishing a plant for making high grade steel.

Edmonton, Alta.—Edmonton Metal Works, Ltd., is erecting a factory building, 75 by 125 feet, costing $25,000. W. J. Magrath is manager of the plant, which will be equipped with modern machinery.

West Lorne, Ont.—The Southern Ontario Gas Co. will install a $200,000 purifying plant at its fields at Port Alma, Tilbury district, to purify all the natural gas to be sold in Western Ontario. This plant, according to the announcement of Frank C. Tomb, will be in operation next fall.

Berlin, Ont.—Berlin will secure a large automobile industry this summer, according to plans just completed. The Regal Automobile Co., of Detroit, will amalgamate with Nyberg Auto Works, of Anderson, Ind., in the establishment of a Canadian factory.

Medicine Hat, Alta.—A building permit has been given out for the radiator factory which is to be built on the South Industrial site by L. Carey Wright. The structure will be of steel and concrete, with factory roof, and will cost $35,000. The dimensions will be 80 by 288 feet. Excavation work has already begun for the foundations.

St. John, N.B.—The announcement is made in connection with the Maritime Motor Show in St. John which has just been closed, that the Dominion Motor Car Co. will put up a factory at Coldbrook, three miles outside of St. John, near the factory of the Ford Company. The new company will assemble there sections of an English car which will be placed on the market throughout the Dominion.

Electrical

Hamilton, Ont.—The Hydro-Electric Commissioners have awarded contracts for street lighting fixtures to the Tallman Brass & Metal Co., of this city, and transformers to the Crocker-Wheeler Co., of St. Catharines.

Winnipeg, Man.—The development of the new Winnipeg electric power plant at Grand Bonnet falls on the Winnipeg river has been started. A gang of 400 men is actively at work cutting out the right of way for a private railway line of 12 miles that the company will build from Lac du Bonnet to the power site. J. G. White & Co. of New York, are the engineers.

Fredericton, N.B.—The construction of a dam across the St. John River at Meductic is proposed by the St. John River Hydro-Electric Company. The project has been laid before the Legislature, and its promoters claim the work will cause an ultimate expenditure of some $3,650,000. The proposed dam will cross the St. John at Meductic, above Fredericton, and transmit power to Fredericton and Marysville, down the valley of the river, over 30 miles to St. John.

Orillia, Ont.—It is rumored that the Ontario Hydro-Electric Commission has completed the purchase of the Big Chute power plant from the Simcoe Railway and Power Co. of Midland. The Commission has for some time been procuring power from this source to supply Midland, Penetanguishene, Barrie, Collingwood, Stayner, Coldwater, Waubaushene, Elmvale, and intermediate points.

Collingwood, Ont.—At a largely attended meeting of citizens under the auspices of the local Board of Trade, a Collingwood branch of the Hydro Radial Union was formed.

Municipal

Walkerton, Ont.—The town council have decided to purchase a road grader.

Trenton, N.S.—The installation of a water supply system, at a cost of $50,000, is proposed by the town council.

Halifax, N.S.—The city council are considering the question of building a municipal abattoir.

Windsor, Ont.—The city council has purchased a steamer from Seagraves, Ltd., and are considering the purchase of auto trucks.

Port Arthur, Ont.—The city council has voted the Port Arthur board of trade $2,500, provided it does the publicity work of the city.

Fort William, Ont.—The city council have appropriated $700 for the purchase of an automobile for the chief of the fire department. Tenders will be called shortly.

Welland, Ont.—At a meeting of the Trades and Labor Council recently the garbage question was discussed at length and a resolution passed advocating an incinerator plant for the town.

Ford, Ont.—A board of trade has been formed here and the following officers elected: Walter L. McCregor, president; Joseph L. Reaume, vice-president; W. A. Komer, secretary; F. W. Johnson, treasurer.

Port Arthur, Ont.—The Customs receipts for the fiscal year just closed passed the million-dollar mark for the first time in Port Arthur's history. The event was celebrated by the officials and staff sitting down to an enjoyable banquet.

Weyburn, Sask.—Four by-laws, viz.—Fire hall, $8,500; waterworks, $105,000; electric plant, $27,000, and sewage disposal, $15,000, will go before the burgesses on May 5, which will allow time for the necessary advertising of the measures. City Clerk Inwards was appointed returning officer for the occasion.

New Liskeard, Ont.—The fire and light committee recommend the purchase of a hook and ladder truck for the sum of $1,050, to be paid for in ten-year debentures. The ratepayers are asked, on April 22nd, when voting on the other money by-laws, to give their opinion as to the advisability of securing the equipment.

Stratford, Ont. — By-laws covering $65,250 were given a second reading at a meeting of the city council on April 20, and the date on which the people will vote on them was made May 18. The five by-laws are:—$22,000 for a new ornamental street lighting system; $10,000 for improvements to the Agricultural Park; $11,500 for an incinerator; $17,250 for additional fire equipment, and $4,500 for a combination chemical and hose wagon, the ratepayers taking their option of a motor-driven or horse-drawn vehicle.

Toronto, Ont.—Works Commissioner Harris has recommended that the contract for the additional filtration plant at the island be awarded to the John ver Mehr Engineering Co. of London and Toronto, as engineers, and Wm. Cowlin & Sons, of Toronto, as contractors, at a cost of $1,066,282. Five tenders were received, as follows: (1) $1,096,277; (2) (Ver Mehr Co.) $1,777,054; (3) $1,500,000; (4) $1,197,580; (5) $1,733,463. The second tender was on the basis of a 72,000,000-gallon plant. A reduction of $110,772 is made from the original figure to bring it down to a 60,000,000-gallon plant as required by the city. The new plant will be that known as the Ransome Drifting Sand Filter, comprising practically a combination of the slow sand and mechanical methods. It will be the largest plant of this system on the continent.

General Industrial

Port Elgin, Ont.—W. A. Mitchell will build a canning factory here.

Toronto, Ont.—The Harris Glue Company will move their plant from 994 Danforth Avenue.

St. John, N.B.—The Jardine & Rive Company will probably build a silicate brick plant at Ketepec.

Port Arthur, Ont.—J. J. Stewart, of Chicago, is at the head of a company who may build gas works here.

Peterborough, Ont.—The Provincial Legislature have appropriated $3,125 for the improvement of roads in this district.

Lindsay, Ont.—On April 13 a fire completely destroyed the elevator owned by Thomas Skuce. The machinery was also destroyed.

Strathroy, Ont.—A by-law will be voted on to authorize the granting of concessions to a company who will build a shoe factory here.

Embro, Ont.—It is reported that Libby, McNeil & Libby, of Chicago, may build a plant, to cost $100,000, to make condensed milk.

Sarnia, Ont.—The Stewart Co., Ltd., are making an addition to their factory. The extension will be 40 x 60 feet, and will be used as a store house for canned fruits.

Iroquois Falls, Ont.—Plans for the erection of paper mills to cost $100,000 have been drawn for the Abitibi Pulp & Paper Co. by Geo. F. Hardy, engineer, New York City.

Wiarton, Ont.—The by-law voted on April 16 for granting a loan of $25,000 to the Canadian Casket Co. resulted in a sweeping majority for the company; 325 votes for and 40 against.

Regina, Sask.—The Western Tire and Rubber Co. will start construction work on a factory in about two months which will cost about $175,000. J. A. Westman and E. D. McCallum are interested.

Courtright, Ont.—Natural gas will, it is expected, be here by June. Representatives of the Union Gas Co. have completed the surveys for the new line, which will be supplied from the main, which runs to Sarnia, six miles distant.

Coaticook, Que.—A site for the new factory to be built by the town for the Charles Neidner, Sons & Co. has been purchased from Gendrean, Boulay & Durocher, for the sum of $900. It is expected that the factory will be commenced very shortly.

Medicine Hat, Alta.—F. A. Boeye, commissioner for the Dunmore Development Company, states that the company has signed up two new industrial concerns to employ a total of 115 men, the particulars of which would be announced in a short time.

Sherbrooke, Que.—The Whiting & Davis Manufacturing Co., jewelers and silversmiths, of Plainville, Mass., will establish a branch of their New England factory in Sherbrooke. Mr. Cooke, the manager, states that the company will occupy a portion of the Peerless Jewelry Co.'s building for the time being.

Harriston, Ont.—It is understood that McColl Bros., of Toronto, who lost their oil plant here by fire on April 4, have decided to continue the Harriston branch of their business. It is the firm's intention to erect a substantial brick building with an up-to-date plant.

Port Arthur, Ont.—The sum of $16,700 has been set aside in the supplementary estimates of the Ontario Government for roads in the Port Arthur district. In addition, $60,000 has been set aside for Mr. Whitson's work in this district out of the special grant of $5,000,000 for Northern Ontario development.

Guelph, Ont.—A change in the management of the Raymond Manufacturing Co., Ltd., has been effected, and the business taken over by the Trusts and Guarantee Co., of Toronto, administrators of the Kloepfer estates. They will continue to manufacture sewing machines and cream separators. The following officers were appointed:—President, E. B. Stockdale, Toronto; vice-president, W. J. Boland, Toronto; secretary, C. S. Hamilton, Toronto.

Sarnia, Ont.—The Union Gas Co., which supplies Sarnia with natural gas, has made a contract with the owners of the Fairbanks gas well at Oil Springs whereby the gas company secures control of the output of natural gas from that well and any other well that the Fairbanks syndicate may locate in the future. The company intends to pipe the gas to Sarnia and Petrolea, and work on the line will be started at once. An order has been given for $500,000 worth of pipe for the new line, and it is expected that the Oil Springs gas will be piped into Sarnia within six weeks.

Railways—Bridges

Toronto, Ont.—The Morrisburg & Ottawa Electric Railway has been given the right to extend its borrowing powers from $20,000 to $30,000 per mile.

Toronto, Ont.—Another extension of time has been granted the Niagara Falls, Welland & Dunville Electric Railway for the completion of their line. The time limit is now March, 1916.

Owen Sound, Ont. A syndicate proposing to build a street railway in Owen Sound, is seeking a 25-year franchise from the town and also proposes that the town guarantee stock in the company.

Montreal, Que.—The C.P.R. is considering a proposition for the electrification of its terminals and the addition of two tracks to the present tracks feeding Windsor street station, at a cost of $1,000,000.

St. Thomas, Ont. — It is understood that the Michigan Central Railway has prepared plans for the viaduct under the tracks in the yards leading from the new work shops to Talbot street, and that the work will be commenced when the new structure is finished.

Toronto, Ont. — The Ontario West Shore Railway has been given a time extension of four years for the completion of the line. This power was granted by the Railway Committee of the Legislature on April 16.

Edmonds, B.C.—Estimated expenditure on roads and bridges in Burnaby this year will be $100,000, according to Municipal Engineer F. L. Macpherson's report, which was submitted at the meeting of the Board of Works held on April 6.

Ottawa, Ont.—The bill of the Montreal & Lake Victoria Railway, a line 320 miles long, to connect Montreal with the National Transcontinental Railway, providing for extension of time, was before the Railway Committee on April 2, but was not finally dealt with and will be up again after Easter.

Thorold, Ont.—At a special meeting of the town council, on April 13, a by-law was passed granting the right-of-way to the St. Catharines, Merritton and Thorold Electric Railway to the factory district. The line, which now ends at the head of Main Street, will be extended past the properties of the Ontario Paper Co., the Beaver Board Co., and the Pilkington Glass Works.

Ottawa, Ont.—According to legislation applied for, a company has been formed to build another bridge across the Niagara River, about half-way between Queenston and the present Suspension Bridges at Niagara Falls. The Ontario-Niagara Connecting Bridge Co. has given formal notice of application at the present session of Parliament for an act of incorporation, with power to construct and operate a railway and general traffic bridge over the Niagara River, near the intersection of the northern boundary line of Welland county with the river.

Toronto, Ont.—The route of the London, Grand Bend and Stratford Railway Co., which is now seeking incorporation by the Legislature, proposes a service through the principal municipalities lying between London and Lake Huron. The projected line traverses the townships of London, Lobo, East and West Williams, McGillivray to the city of Stratford, through the townships of Stephen and Usborne in Huron county, the townships of Hibbert, Fullarton, Biddulph, Blanchard and Downie in Perth County. The capital of the company is to be $2,000,000, with bonding powers of $35,000 per mile.

Building Notes

Edmonton, Alta.—The city will erect an addition to the Manufacturers' Building at a cost of $88,000. A new heating plant will be installed.

Sarnia, Ont.—The Dominion Salt Co. are making an extension to their factory. When completed the new building will be 100 x 40 feet and one-storey high.

Port Arthur, Ont.—The Methodists of Port Arthur will build a $10,000 parsonage this year on the church property for their pastor, Rev. G. K. B. Adams.

Toronto, Ont.—The Ford Motor Co. was granted a permit on Monday for a five-storey concrete factory and shop, to cost $160,000, in Dupont Street, near Christie Street.

Galt, Ont.—Plans for the erection of a new city hall have been accepted from a local firm of architects in competition, and work on the $25,000 building will be commenced at once.

Port Arthur, Ont.—Already preparations are in progress for a very busy building season. $80,000 is to be spent in residences in Mariday Park, all of them will be modern houses.

Calgary, Alta.—The new Industrial Housing Building will be seven storeys high and of reinforced concrete construction. Tenders are being received by Mr. A. Pirie, architect. The estimated cost is $200,000.

Port Arthur, Ont.—Work on the excavation for the new Customs building on the corner of Arthur and Water streets is being rapidly proceeded with. The structural steel for the entire building is on order, for delivery by June.

Toronto, Ont.—An enlargement will be made immediately of the new Bell Telephone building on Adelaide Street West. The building extends only about half-way back the lot at present, but plans have already passed the City Architect's Department for the extension of the building through to Temperance Street. The extension will be a five-storey brick, stone, terra cotta and steel fireproof building, costing $33,000.

Contracts Awarded

Toronto, Ont.—The Simcoe county council has awarded the Hamilton Bridge Co. the steel contract of the new 125-foot bridge over the Nottaswaga River at Nicolston. The bridge is to cost $9,000, and the steel contract is half the amount.

Port Arthur, Ont.—Marsh, Hutton & Powers, contractors of this city, have been awarded the contract for the new $755,000 breakwater to be constructed at Vancouver by the Dominion Government.

Toronto, Ont.—The York County Commissioners, at their meeting held on April 14, awarded the contract for the 40-foot concrete arch bridge on the Dawes road to McDougall & Toole, of Midland, for $3,137.

Saskatoon, Sask.—The contract has been awarded by the city council of Saskatoon to the Rensselaer Valve Co., of Troy, N.Y., for the supply of 12-inch cast-iron pipe at $38.70, 16-inch at $74.21, 18-inch at $97.97 and 20-inch at $125.52; totalling $672.80.

Port Arthur, Ont.—The contract for the construction of 2,500 feet of breakwater in the harbor here has been let to the Port Arthur Construction Co., Ltd. The contract amounts to $500,000 and the company have been authorized to proceed with the work as soon as possible.

Saskatoon, Sask.—The contract has been awarded by the city council of Saskatoon to the United States Cast Iron Pipe & Foundry Co., of Chicago, Ill., for the supply of cast iron pipe A at $41.80; (B) at $41.30, totalling $3,186.10; and for specials at $75, totalling $975.

Montreal, Que. — Seventeen motor trucks have been ordered by the Board of Control for the Public Works Department, at a cost of about $100,000. The order includes nine "Delohaye" trucks, of which seven are of five tons capacity and two of three tons; four "Peerless" trucks, of five tons capacity; and four "Berliet" trucks, carrying five tons each.

Victoria, B.C.—Contracts for equipment required by the city electric lighting department were awarded by the city council on April 6, as follows: To D. L. Hickey & Co., and Hawkins & Hayward, in equal shares, for 5,000 pounds of copper line wire at $19.30 per 100 lbs.; to the Canadian General Electric Co., for two gross of arc light globes at $417.

Windsor, Ont.—Contracts for the transforming stations in Windsor and Walkerville for the Hydro-Electric system have been awarded. The Windsor contract was secured by H. J. Christman, of Hamilton, for $10,000. The Walkerville contract was given to Wells & Gray, of Windsor, their figure, $9,650, being the lowest bid. Engineers of the Ontario Hydro Commission say that power from Niagara will be available for use in Windsor by July 1.

ASSOCIATION AND PERSONAL

A Weekly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Machinery Circles

Trade Gossip

The Hamilton Facing Mills Co., Hamilton, Ont., are starting to market graphite boiler compound. They have installed special machinery for making this specialty.

The D. McKenzie Machinery Co., of Guelph, Ont., have purchased a site and plans are being prepared for a new machine shop. The site is 80 x 200 feet. and will be entirely covered with buildings.

Great Lakes Transportation.—Announcement is made of the incorporation of the Great Lakes Transportation Co. with a capitalization of $1,000,000, and head office in Midland, Ont. Mr. James Playfair formed the new concern.

Nova Scotia Iron.—A report from Philadelphia states that the first cargo of free iron ore has arrived at that port from Nova Scotia. The cargo was from Louisburg, C.B. Preparations are being made for regular traffic in iron ore between these ports.

The Corbett Foundry & Machinery Co., of Owen Sound, Ont., have recently patented and are now making a steam towing winch. The winch has a cylinder 8 inches diameter by 8 inches stroke, and will carry 200 fathoms of 1 inch hawser with spooling gear.

W. H. Banfield & Sons, Toronto, advise us with reference to the recent Government contract for 100,000 parcels post boxes that they will simply supervise the manufacture; the International Mail Equipment Co. of Canada providing the plant, equipment and material.

Judgment for Machinery.—Judgment for $4,776.37 has been granted by Mr. Justice Middleton in favor of the Allis-Chalmers-Bullock, Ltd., for hydraulic and electrical machinery supplied to the Algoma Power Co. of Berlin, which operates a power house at Michipicoten. The suit was for $10,000.

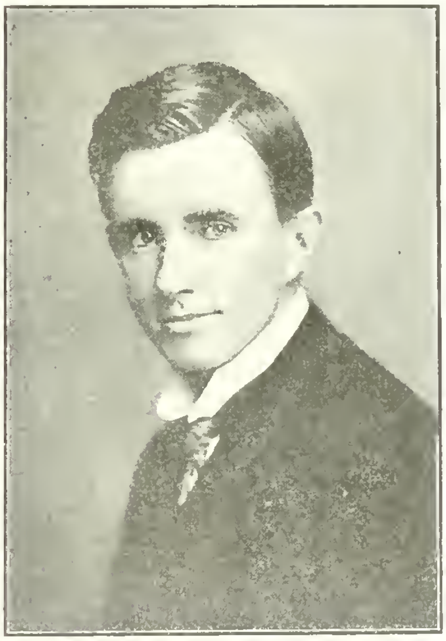
The Wm. Hamilton Co., Peterborough, Ont., have been awarded a contract by the Corporation of the City of Windsor for the supply of all the ornamental iron standards required for the street lighting in the business district of the city. There will be approximately 300 of these standards required, and they will carry magnetite arc lamps.

Kingston, Ont.—The Davis dry dock was filled for the first time this season last Wednesday, and the new tug which this company built during the winter months was floated, as well as the two yachts which were also placed there for the winter. After these went out, the steamer Rideau Queen entered and will undergo a general overhauling and painting.

Will Ruin Industries.—J. G. Merrick, secretary of the Employers' Association, speaking on the minimum wage of $15 a week for unskilled workmen instituted by the City Council of Toronto, said that it would mean the ruin of industries and cause discontent among other workmen. He thinks it will have the effect of drawing men from the industries, during the summer months, who have been trained during the winter for special work.

Send Trade Commissioner.—Manufacturers in the Old Country having shown such a lukewarm attitude towards the proposed British exhibition train to tour Canada, the Canadian Associated Press learns that subscriptions are now being sought to send a British commissioner to Canada to study the opportunities for trade with the Dominion, especially in view of the opening of the Panama Canal. It is hoped a hundred firms at least will be willing to subscribe $125 each towards this object.

WHO'S WHO.



ALEXANDER GRAY.
President the Gray Mfg. & Machine Co., Toronto.

Personal

C. B. Carter, for two years municipal engineer of West Vancouver, has resigned.

John A. Wilson, city engineer of Kamloops, B.C., has resigned and has been succeeded by Mr. E. Kingwell.

R. H. Harcourt, sales manager of the Canada Steel Forgings, Ltd., Montreal, spent Easter at his home in Welland.

Sir William Whyte, late vice-president and director of the C. P. R., died at Coronado Beach, Cal., on April 14, at the age of 71.

W. G. Ross, president of the Montreal Harbor Commission, is proceeding to Nice, after completing his harbor investigation tour in Europe.

Alexander Watson died on April 18, in Toronto, aged 83. Mr. Watson was connected with the Gartshore Foundry Co., Hamilton, for many years.

C. M. Arnold, formerly city engineer of Lethbridge, has resigned his position with the C.P.R., as assistant engineer of the irrigation department in Alberta.

Herbert Douglas, lately of the mechanical department of the C.P.R., has received the Provincial Government appointment of assistant inspector of factories for British Columbia.

Graham Drinkwater, vice-president of the Canadian Fairbanks Morse Co., who for the past fortnight has been confined to his house with pneumonia, is making satisfactory progress towards recovery.

Norman A. Ruse, assistant commissioner of the Board of Trade, has been appointed publicity commissioner for the city of Regina, at a salary of $1,800 a year, his duties to commence immediately.

S. B. Wass, chief engineer of the Quebec Extension Railroad, is undertaking the work of assistant chief engineer of the St. Johns (Que.) Railway, a proposed line 174 miles long in Quebec and the State of Maine.

S. George Boswell, chief engineer of the Quebec Harbor Commission, has just returned from a six weeks' trip to the Old Country. While on the other side, Mr. Boswell inspected a new crane, dredge and tug, which are being built for the commission.

Marine

Ottawa, Ont.—It is stated that a contract for buoy service on the Detroit River, has been awarded to Kenneth Fraser of Detroit, Mich.

Hamilton, Ont.—It is stated that the Dominion Government have appropriated a million dollars for harbor improvements. A large part of the money will be spent in the development of Stipes Inlet.

Wiarton, Ont.—The Canadian Tug & Towing Co. has purchased the Homer F. Warren, of the Shannon & Gary fleet. The consideration is private. The Kerner is being fitted out, and will be taken to Wiarton.

Sault Ste. Marie, Ont.—The Lake Superior Dry Dock and Construction Co. is going ahead with its programme of building a dry dock and shipbuilding yard. The $25,000 forfeit given the city still remains on deposit by consent of the company.

Port Arthur, Ont.—It is reported that the tender of the Port Arthur Construction Co., Ltd., has been accepted for the construction of the breakwater extension in Port Arthur harbor from its present termination opposite the C.N.R. coal docks towards Fort William.

Owen Sound, Ont.—Rumor here says that James Playfair will acquire the control of the Dominion Transportation Co., whose system includes the steamers on Georgian Bay, the Manitou, the Caribou, in addition to several tugs and steamers on Lake Superior.

Sarnia, Ont.—The engines of the steamer Matoa will be transferred to the steamer Peck. The Matoa is owned by the Reids, and was salvaged from the rocks at Point aux Barques. The Peck, which is at Detroit at present, is owned by the Reids and McKay, of Hamilton.

Ottawa, Ont.—Two million dollars for a harbor at St. Croix, Charlotte County, New Brunswick, was asked by a delegation which saw Hon. Robert Rogers and Hon. J. D. Hazen on April 1. It was claimed that the harbor is open all the year round, and is one of the best natural ports of Canada. The delegation got no definite assurance.

Quebec, Que.—Mr. A. Gravel, chairman of the Levis Board of Trade and member of the Quebec Harbor Commission, has received a letter from the well-known ship-building firm of Sir W. Armstrong, Whitworth Co., with reference to the establishment of a branch of that firm across the river at Levis, in connection with the new graving dock, on which work is to start in a few days.

Montreal, Que.—Preliminary work on harbor improvements estimated to cost this season $3,000,000 has been commenced, and include the completion of the 20-foot channel by diverting part of St. Mary's current, electrification and extension of the high level railway, besides dredging and improvement of wharves and piers.

Collingwood, Ont.—The Collingwood Shipbuilding Co. have handed over to the Windsor and Pelee Island Navigation Co. the new passenger and package freight steamer, "Pelee," which has been under construction in the yards during the past winter. On April 15 the steamer made her trial trip, maintaining a mean speed of 14.6 miles per hour.

Canada's Merchant Marine.—Capital estimated at $26,908,950, invested in 8,545 Canadian vessels, while 43,968 men and boys are employed in the marine service, according to the annual report just issued by the registrar of shipping. The number of vessels registered is 8,545, and the tonnage is 896,965, an increase last year of 344 vessels. Steamers number 3,847, and the tonnage 711,512. Of the 344 new vessels added to the register last year the value is $1,807,380.

Ottawa, Ont.—A delegation from St. Stephen, St. Andrews, and Milltown, recently asked $2,250,000 from the Government for the improvement of St. Croix harbor at the mouth of the St. Croix river. A favorable report of the possibilities of this harbor was made by Engineer A. D. Swan, and the delegation from Charlotte county wished to emphasize the recommendation and to have the approval ratified in cash. Hon. Mr. Rogers promised consideration.

Hamilton, Ont.—While in Ottawa with the deputation from Hamilton and other cities urging greater waterways and hydro radials, Engineer MacCallum had a conference with Hon. Robert Rogers, Minister of Public Works, and was assured that by the time the new Welland Canal was completed, Hamilton's canal at the beach would be deepened to the standard of twenty-five feet and converted into two channels, instead of one, with a pier in the centre.

Sarnia, Ont.—The Northern Navigation Company's steamer Saronic has been sold to the Canadian Steamship Company, and it will be used as a passenger steamer on the St. Lawrence River. The boat has been on the run between Sarnia and Port Arthur since 1883. When she first left the shipyards she was known as the United Empire. At the time of her launching she was considered the acme of shipbuilding, and her size at that time was considered immense.

"Safety First" Campaign--Canadian Car and Foundry Co.

Staff Article

An encouraging sign of progress is seen in the lively interest now being evinced in the "Safety First" movement by our leading industrial corporations and railways. No movement initiated during the past few years has made more rapid progress: this is clearly indicated by the diminution in the number of serious accidents. The following account of what our largest car building company is doing to promote the safety of its employees will doubtless be read with interest.

THOUGH of comparatively recent growth, it is clear that the "Safety First" movement has come to stay, and whether looked at from the humanitarian or from the strictly utilitarian point of view, it is equally to be commended. It is a movement that can be just as well installed in a small shop as in a large manufacturing plant, and the returns to be obtained from it, both in the saving of life and limb and also in the elimination of compensation payments, will more than justify the initial outlay required to adequately fence in dangerous machinery and otherwise protect workmen from accidents, whether due to their own carelessness or not. The word "carelessness" is used advisedly, for there is no gainsaying the fact that a large percentage of industrial accidents are directly attributable to want of ordinary caution on the part of the persons injured. To save himself a walk of 100 feet or so round the end of a string of standing freight cars, which may be blocking a track he has to cross, a man will often climb between two of the cars. Ninety-nine times out of one hundred no mishap results, but the one-hundredth time the yard switch engine backs up just as he is climbing over the couplers; he is thrown down, and perhaps loses an arm or a leg. Employers of labor can do little or nothing to prevent accidents of this kind beyond the display of conspicuous warning notices. In fact, the whole success of the Safety First movement depends almost entirely on the co-operation of the men; hence the importance of an aggressive educational campaign on the part of employers.

FIG. 1. BOARD FOR DISPLAY OF "SAFETY FIRST" BULLETINS.

FIG. 2. EMERY WHEEL GUARD MADE UP FROM CHANNEL IRON AND STEEL PLATE.

This educational feature is one to which the Canadian Car and Foundry Company are paying close attention in connection with the Safety First movement which they inaugurated a few months ago. In December last a general committee was organized at the head office in Montreal, and plans for an aggressive Safety First campaign were then formulated. The scheme is being carried out along the same lines in all the plants of the Canadian Car and Foundry Co., and also in those of the allied concerns, Canadian Steel Foundries, Ltd., and Pratt & Letchworth, Ltd.

Organization.

Each plant has a local Safety First committee of from three to five members, inclusive of the superintendent. This local committee investigates every accident occurring in its own plant, and reports thereon to the general committee, accompanying its report, if possible, by a recommendation of some nature for preventing a recurrence of such an accident. The members of the local committee are always on the lookout for means of improving existing safeguards, and welcome suggestions along these lines for men in the shops.

The general committee meets about once a month at each of the plants in rotation. It considers the reports sent in by the local committees, and if the suggestions contained therein be approved, they are embodied in a "Safety Bulletin" and distributed to all the plants. In this way caution signs, safety appliances, etc., are standardized, it being compulsory on each plant to closely follow out the instructions contained in every bulletin issued, so far as can be done without interfering with the operation of the plant. Copies of each new

bulletin issued are forwarded to the superintendents of the various plants, and are by them distributed to members of the local committee, foremen and others. Copies are also displayed on a large bulletin board at the entrance to the works, see Fig. 1. These boards form one of the principal means adopted for educating the men in the importance of the Safety First idea. Upon the boards are affixed cartoons and other illustrations showing how serious accidents have happened and how they might have been avoided. For instance, one cartoon shows a man chipping a casting. Across the shop another man is seen similarly employed. Neither man is wearing the goggles provided for use, failing thereby to realize that he is exposing others besides himself to chances of injury. Suddenly each of the two men is struck in the eye by a chip from the other man's chisel.

These illustrations are changed at frequent intervals, and there is always a crowd round the board whenever a new set is displayed—an encouraging sign of the interest evinced by the men. The company also publish a little monthly welfare magazine, a copy of which is delivered free to every employee. One section of this magazine is devoted entirely to Safety First news, and the principal safety bulletins issued by the general committee are published there from time to time.

After each monthly meeting the general committee makes a visit of inspection through the plant at which the meeting has been held, and inspects the work of the local committee to see that they are following out the instructions contained in the Safety Bulletins. There is a healthy rivalry between the various plants as to which shall have its machinery most efficiently guarded, though the appliances are becoming so rapidly standardized that there will soon be little to choose between them. In addition to looking after Safety First, the committee devises methods for improving sanitation, preventing fire, etc., and might aptly be called a "general welfare committee."

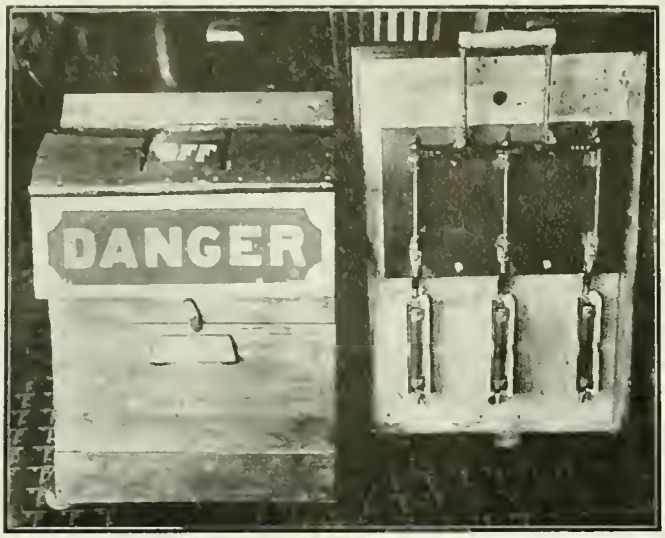


FIG. 3. TYPE OF BOX USED FOR COVERING STARTING SWITCHES, ETC.

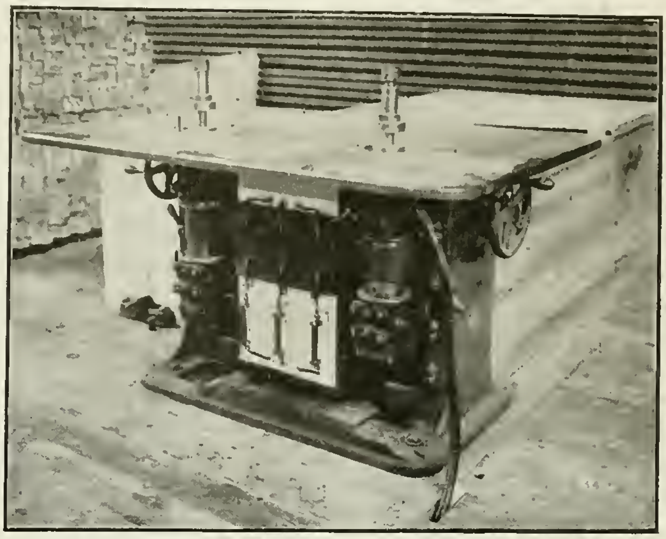


FIG. 4. SHAPER WITH STARTING SWITCH EXPOSED.

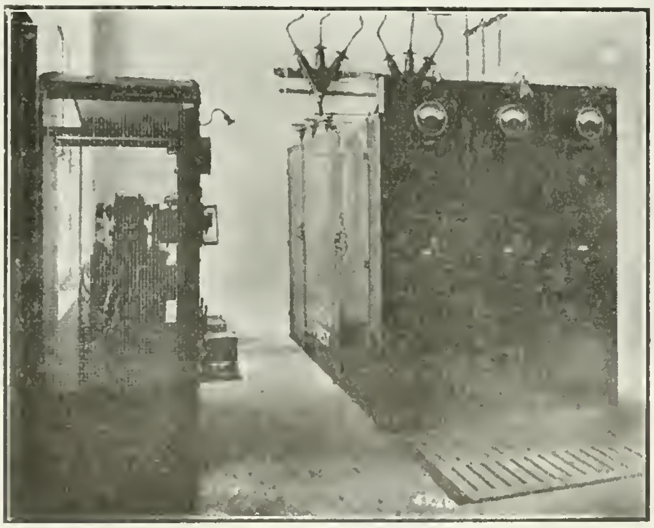
Methods Adopted.

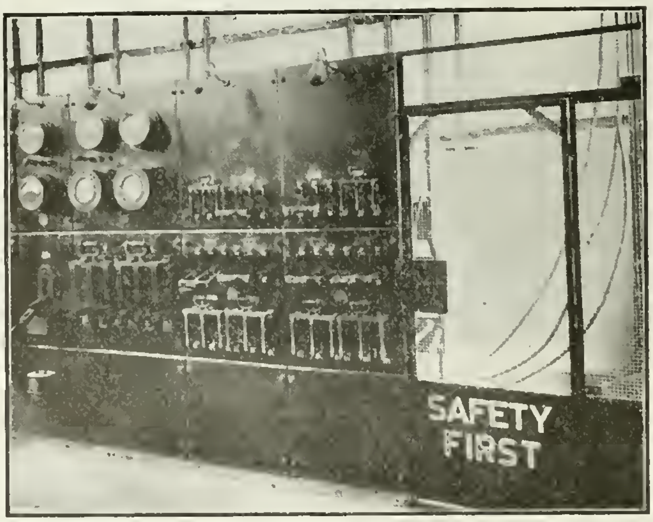
Above the entrance to each shop is painted the name of that particular department, and underneath it the words "Safety First," thus:

TRUCK SHOP.

SAFETY FIRST.

Signs reading "Look out for Cars" are placed at corners near railroad tracks, and the "Safety First" slogan is displayed at every advantageous point. For instance, the cage of every overhead traveling crane in the shops is





FIGS. 5 AND 6. WIRE DOORS AND PARTITIONS IN TRANSFORMER HOUSE GUARDING EXPOSED HIGH VOLTAGE WIRES. THE WOOD SLAT FOOTBOARD HAS NO NAILS IN IT, WOODEN PEGS BEING USED INSTEAD.

painted white, and has the motto stenciled on it in large black letters.

Men are employed at each plant to go round the yards and shops looking out for projecting nails or anything else that might cause an injury. Many a man has stepped on a rusty nail and suffered serious blood-poisoning afterwards on account of having neglected what seemed at first to be merely a trifling wound.

The use of set screws has been abolished as much as possible, and where their use is absolutely necessary they are of the hollow or countersunk type, or else are placed in safety collars having flanges high enough to afford efficient protection.

In Fig. 2 is seen an excellent emery wheel guard in use at the Dominion plant, Montreal. This, made up from a small channel iron with sides of 1/4-inch steel plate, covers up the wheel very completely. To avoid all danger of a man's overalls or coat getting caught by the nut on the end of the spindle, the latter is covered in by a wire screen, as shown. Men operating these grinders are provided with light, comfortable goggles, and also with aprons made of two pieces of sole leather riveted together with steel brads. These aprons protect the abdomen from the vibration of the wheel. As the wheel wears down, the guard can be set back by means of the elongated holes in the bracket supporting it. Although this guard has proved very efficient, it is understood that the Safety First committee are now working out an even better design in cast steel.

FIG. 7. SHOWING OPERATOR PLANING SHORT NARROW STOCK ON BUZZ PLANER WITHOUT USING SAFETY APPLIANCES. IT IS AN EASY MATTER TO LOSE ONE OR MORE FINGERS THIS WAY.

FIG. 8. HOW SHORT STOCK SHOULD BE PLANED. A HEAVY GUARD COVERS THAT PART OF THE KNIVES NOT REQUIRED, AND STOCK IS PUSHED FORWARD BY A WOODEN BLOCK FITTED WITH CONVENIENT HANDLE.

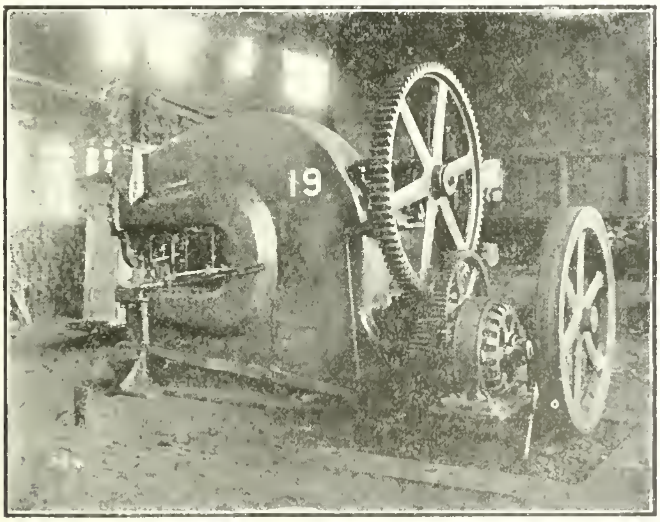


FIG. 9. MOTOR-DRIVEN PUNCH WITH FLYWHEEL AND GEARS EXPOSED.

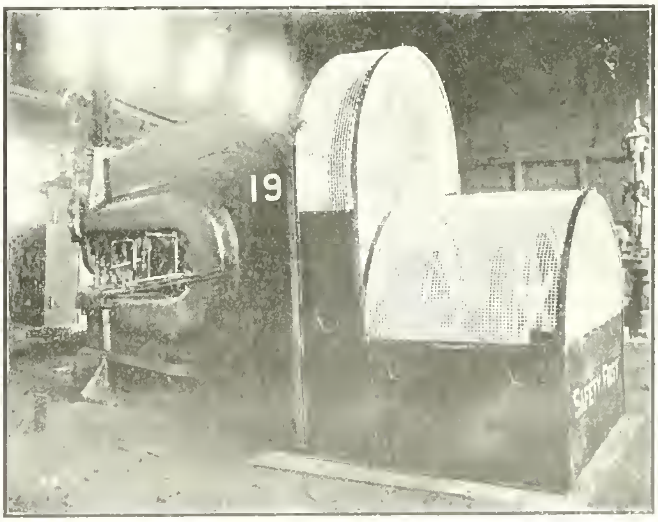


FIG. 10. THE SAME MACHINE FULLY PROTECTED, WHILE THE GUARD CAN BE READILY OPENED UP FOR OILING GEARS.

Fig. 3, shows a type of box, lined with non-combustible insulating material, which is used to cover all switches, fuses, circuit breakers or other electrical parts exposed to weather, dampness, or contact with inflammable material, or where employees are liable to make accidental contact with live parts. The latter accident would be very liable to happen in the case of the shaper seen in Fig. 4, if the switch were left exposed. At the Longue Pointe plant of the Canadian Steel Foundries, Ltd., a small refinement has been added to this switch box in the shape of a small hasp and padlock. Two keys for the latter are provided, one being carried by the superintendent and the other by the head electrician. This prevents any unauthorized person from replacing a blown fuse or tampering with the switch in any way.

Figs. 5 and 6 show wire doors and partitions guarding exposed high voltage

wires in a transformer house. One of the safety bulletins issued by the general committee calls for the use of rubber or wood slat mats in front of and behind every switchboard, and one of these wood slat foot-boards is seen in

FIG. 11. GEAR GUARD ON DOUBLE-ENDED PUNCH AND SHEAR.

FIG. 13. ENCLOSURE FOR A PRESSURE PUMP OPERATING AN HYDRAULIC PRESS. ALSO BELT GUARD.

Fig. 5. It is made from pitch pine and is fastened together with wooden pegs in place of nails, to eliminate all possibility of shock to the operator.

Electricians are provided with painted signs reading "Under Repair," and have orders to display this sign in a conspicuous position on any crane or machine the electrical equipment of which may need attention.

Guarding Machinery.

Probably no machine in a planing mill is responsible for a greater number of lost fingers than the buzz planer, though

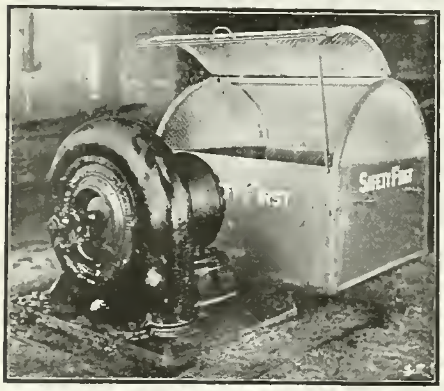


FIG. 12. COVER FOR MOTOR-DRIVEN FAN.

the band saw perhaps runs it a close second. Fig. 7 shows a small piece of stock being planed in a buzz planer. The knives are exposed throughout their full length and the operator's right sleeve is actually touching the table and may easily be caught by the knives. Fig. 8 shows how the operation is performed in the shops of the Canadian Car & Foundry Co. An adjustable guard covers up that part of the knives not required and short, thin stock is pushed forward by a hand block somewhat similar in appearance to a hand plane. The notice board back of the machine reads:

> Portion of knives not in use to be kept covered. No one allowed to use this machine unless authorized to do so. Use hand block for thin and short stock.

In Fig. 9, is seen a large punch with its motor, gears and flywheel dangerously exposed. Such machines as this usually have a pile of plates or angles near them, and it would be an easy matter for a man, in walking over these, to slip and fall with his hand in the gears.

Fig. 10 shows how this punch has been fenced in. The guard here seen is typical of most of those used throughout the company's plants for fencing machine tools. The lower part consists of 1/8-inch plate, while the upper part is made from wire netting—1/8-in. wire with 1/2-in. mesh. The corners and bottom edges are made with 1 1/4-inch angles, and the whole forms a neat, self-supporting guard, sufficiently heavy to retain its stiffness and appearance indefinitely. The netting is riveted, not bolted, to the angles. The rivets pass through the netting and are clinched on a 1 x 3-16 strap on the other side. The upper part of the guard covering the motor and flywheel is hinged at the top and provided with a prop to hold it up during the oiling of the gears—see Fig. 12. This type of guard could be made lighter if it were entirely of netting, but the solid lower half adds to the appearance, keeps dirt kicked up from the floor from entering the motor and gears, and greatly adds to the solidity of the whole.

From the neat appearance and high finish of the protective devices illustrated, the reader might infer that they are made up from carefully dimensioned blue prints sent out from the drafting office, but such is not the case. They are made up in the shop from measurements taken from the machine to be guarded. A few men were trained in this work in one of the largest of the plants and quickly became efficient. They were then distributed among the other plants to organize a gang of men in each, who give their whole time to this feature. As may be seen from the illustration, all guards are fitted with substantial

FIG. 14. GUARD FOR ENCLOSING GEARS OF BOLT CUTTER OR SIMILAR MACHINE.

handles by which they can be removed by three or four men, or by the shop crane, when repairs to the machine have to be effected.

A neat casing for the pinion and gear of a large double-end punch is seen in

Fig. 11. Though the chances of getting a hand crushed here are practically negligible, it was thought advisable to install the guard and thus avoid the risk of a man's striking his head against the teeth of the large gear after stooping to the floor to pick up some object. This guard is hung by two iron straps from the top housing of the punch and is held at the bottom by a stud and light bracket. It is of course, made in halves.

Fig. 12 is introduced merely to show the general style of construction of these guards. This example is used to cover the motor-driven fan seen in the foreground.

Fig. 13 shows an inclosure for a hydraulic pressure pump. A door fitted with a pad-lock allows authorized persons access to the pump. This pump stands out some distance from the main shaft: hence the driving belt makes an acute angle and that part of it which would be liable to cause an accident has been guarded as shown.

Fig. 14 shows a modification of the same type of guard, suitable for protecting the back end of a bolt cutter or similar machine. It rarely happens that the same guard is suitable for more than one machine in the shop, and careful measurements are taken and a new guard made for each different unit.

Fig. 15 shows one of the guards applied to a high-speed hack-saw machine. It not only fully incloses the crank and driving pulley, but is carried up sufficiently high to prevent any possibility of a passer-by coming in contact with the belt.

A motor-driven hydraulic wheel press is shown in Fig. 16, and the same press with motor and gears fully inclosed in Fig. 17. This cover has a very neat appearance, but is to be superseded by one having panels of wire netting to ventilate the motor and allow inspection of the gears. On all wheel presses a safety bulletin is conspicuously placed, reading as follows:

SAFETY FIRST.

A loose wheel may result in serious injuries and great damage. A man to be fit for this job must never take any chances of a loose wheel getting into service.

FIG. 15. GUARD FOR HACK-SAW MACHINE.

Though the illustrations accompanying this article deal principally with the guarding of machinery, it must not be inferred that the general and local committees devote most of their attention to this part of the Safety First movement. A great deal of time is spent in devising new rules or improving old ones, regulating the conduct of crane men, electricians, switching crews, grinders, yard laborers, etc. Up to the time of writing, about twenty safety bulletins have been issued, dealing with as many different subjects.

Personnel of General Committee.

The general committee, to whom is due a large share of the credit for the success which the movement has already achieved, consists of the following members:

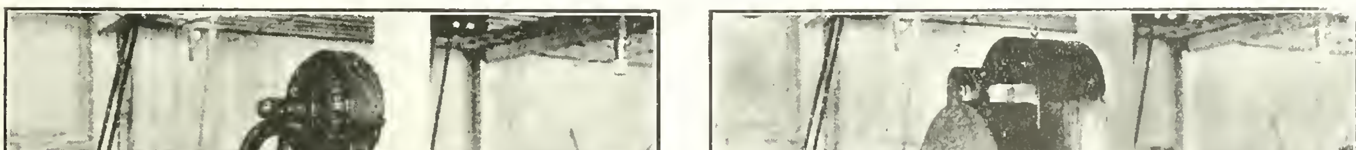
W. S. Atwood, chairman.
L. H. Curry, vice-chairman.
F. A. Skelton.
C. J. Mahoney, secretary.

The superintendent, or manager, of each plant is also a member of the general committee, as are, ex-officio, all executive officers of the various companies.

Ambulance Work.

In spite of every precaution accidents will happen. Consequently, although the subject is not directly connected with the "Safety First" movement, a brief account of the ambulance work carried on by the Canadian Car & Foundry Co. and the affiliated companies may not be without interest.

A fully qualified medical man devotes his whole time to looking after the health of the companies' employees. To do this he has assistants at the Longue Pointe, Amherst, Brantford and Welland plants. At each of the works there is a well-equipped hospital, where minor injuries are treated by the doctor, or in his absence by a qualified first-aid man. The doctor visits each plant at a certain hour every day and men who have met with injuries, if able to get about, can call at the works hospital and get treatment every day until able to resume work. If their injury confines them to bed, the doctor visits them in their homes, no charge being made for the service in either case. An excellent rule in force at all the plants compels every employee receiving an injury, however slight, to visit the works hospital at once.



FIGS. 16 AND 17. SHEET METAL COVERS FOR MOTOR AND GEARS OF HYDRAULIC WHEEL PRESS.

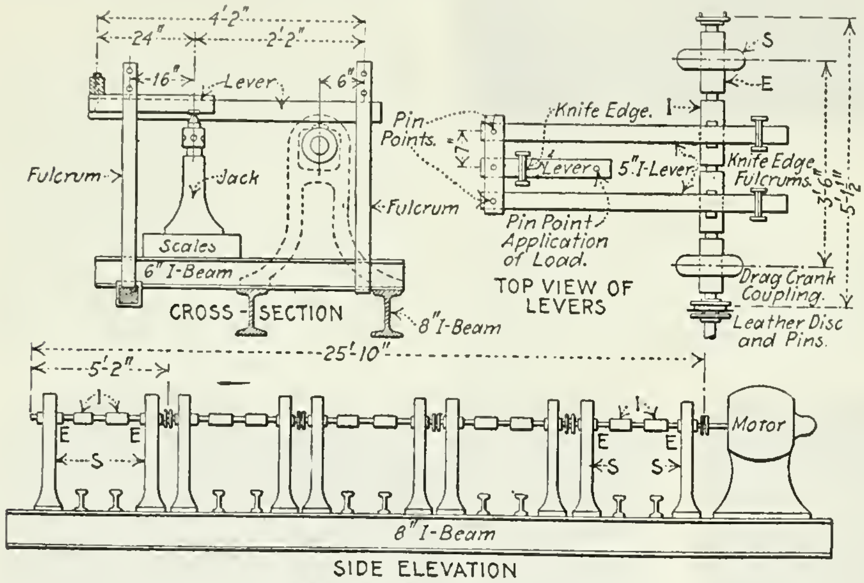
Comparative Tests of Three Types of Line Shaft Bearings

By C. C. Thomas, E. R. Maurer and L. E. A. Kelso.*

This paper, read before the A.S.M.E. and published here in abstract, covers experiments made to determine the absolute and relative amounts of power required to drive a series of uniformly loaded and flexibly connected shafts supported successively by three different types of bearings.

THE tests from which the accompanying data is derived extended over a period of four years, and were finally repeated and all results checked by a set of skilled observers, who had formerly no connection with the work. Twenty ring-oiled babbitt bearings supported successively a series of uniformly loaded and flexibly connected shafts, a wide range of loads and speeds being covered and co-efficients of friction worked out for each type.

The apparatus was designed and built in the department of steam and gas engineering at the University of Wisconsin, in collaboration with the manufacturers of the bearings, and was so arranged that very exact measurements of power were attainable. All questions of possible lack of alignment, non-uniformity of loading, temperature and quality of lubricant, etc., were given careful study, resulting in the special form of apparatus used.



APPARATUS FOR TESTING LINE SHAFT BEARINGS.

Description of Apparatus.

The apparatus consisted of 25 ft. 10 ins. of line shafting in five equal sections, mounted in hangers (S), which were inverted and used as floor stands, Fig. 1. The hangers were bolted to two 8-in. I-beams. The shafts were of cold rolled steel, 2 7/16 in. in diameter, each section being 5 ft. 2 ins. long. The adjacent sections were coupled together by means of a flexible leather disk or two straps connecting the two flange couplings. The flexible couplings prevented the transmission of any part of the load applied on one shaft to either adjoining section, and also prevented binding between shafts and bearings due to possible lack of alignment.

A direct-current Fort Wayne motor was directly connected to one end of the shafting by means of a flexible coupling. The motor was of the interpole type with the interpoles removed, making it a shunt motor. A water rheostat was used in the field circuit to maintain a constant field, and another water rheostat was used in the armature circuit to vary the speed by varying the impressed voltage. The lost power was obtained first by taking the armature resistance for various currents and plotting a resistance, armature-current curve. From this curve was plotted an armature-I^2R loss, armature-current curve. From this the armature resistance loss for any armature current was obtained. The stray-power loss was obtained by taking a stray-power loss field current curve for each speed; then for any speed the loss for that speed and field could be obtained. By use of this method, the power required to run the motor alone at all speeds, without load, was accurately ascertained, as well as the power required to run the motor and shafts together, at all loads and speeds. The relative amounts of power required to overcome the friction of the various types of bearings were, therefore, accurately determined.

Application of Load.

The load was applied through levers upon hardened knife edges and pin points as fulcrums. Across the top of the 8-in. I-beams and at right angles to them were bolted short 6-in. I-beams to which the fulcrums were attached. The loads were applied to the shaft by two bearings between each pair of hangers. These bearings were identical with those in the hangers, and were supplied with knife edges which engaged a V-shaped groove in the 5-in. I-beam levers. The bearings and hangers for each section were symmetrically placed with respect to the middle of the section; therefore, equal loads on the intermediate bearings (I) produced equal pressures on the end bearings (E). These latter pressures exceeded those on the intermediate bearings by one-half the weight of the shaft, or by 40 lb. This difference is regarded as negligible in the paper, and load per bearing means average of the loads on intermediate and end bearings. The bearings were prevented from turning by short levers fastened to them and resting upon uprights from the floor. Only one type of bearing was tested at a time, so that no complications might arise in establishing the losses for the particular form under test. The reason for using 20 bearings was that the amount of power necessary for a single bearing was so small as to be difficult of exact measurement. Also any single bearing might not as truly represent results from that type of bearing in general as several bearings taken together.

The Bearings Feature.

The three kinds of bearings tested were:—The ring-oiled bearing, manufactured by The Dodge Mfg. Co., lined with babbitt metal made from their formulae; the Hyatt roller bearing, manufactured by the Hyatt Roller Bearing Co.; and the Hess-Bright ball bearing, manufactured by the Hess-Bright Mfg. Co. All bearings were for the same size shaft, and, in fact, the same pieces of shafting were used for all the tests, except that two sections which bent during the tests were replaced.

*Professor of Mechanical Engineering, Johns Hopkins University; Professor of Mechanics, University of Wisconsin, and Instructor in Electrical Engineering, University of Wisconsin, respectively.

The babbitt bearings were 9 21/32 in. long, and hence their projected area was 22.36 sq. in. The following table is appended for converting total loads used in the tests into unit loads:—

730	1230	1730	2230	lb. per bearing
33	55	78	100	lb. per sq. in.

These bearings were oiled by the well-known ring-oiler device, two rings in each bearing.

Each roller bearing contained six right-hand and six left-hand rollers, .78 ins. in diameter; six being 9 9/16 ins. long, and six being 9 3/16 ins. long. They were of the type in which a cage is used for holding one-half the rollers. Each ball bearing contained a single set of balls, 9/16 ins. in diameter, while the diameter of the inner race through the ball groove was 3.4729 inches. The power was measured by the ammeter voltmeter method, while mercury thermometers (two in each babbitt and roller bearings and one in each ball bearing) were used for measuring the temperature of the oil or bearing.

The speeds used in the tests were between 150 and 450 r.p.m., corresponding respectively to about 100 and 300 ft. per minute peripheral speed. Most of the loads used were between 700 and 1800 lb. per bearing, corresponding respectively to about 30 and 80 lb. per sq. in. for babbitt bearings. All statements of results, therefore, are subject to the above limitations as to speed and loads.

Two lubricants were used in all the tests—Atlantic red engine oil in the babbitt and roller bearings, and No. 2 Keystone grease in the ball bearings.

Results of Tests.

For all conditions of load and speed the power decreased with increase of temperature, but the rate of decrease at the highest load and speed was more marked in the case of the babbitt bearings. At the lower speeds the power did not vary at all with the temperature, practically speaking.

In a comparison of the babbitt, roller and ball bearings for 100 degs. and 77 degs. temperature, it was shown that the power for the babbitt is higher than for the other bearings except perhaps at low loads and speed, and that the power for rollers is higher than for balls. The excess of power for babbitt over rollers and rollers over balls increases with increase of speed for all loads. Table 1 shows the relative amounts of power consumed in friction by the three kinds of bearings at the speeds and temperatures indicated. The relative numbers are based in each case on the average power for three loads: 710, 1210, and 1710 lb. for balls; 740, 1240, and 1740 for rollers; and 730, 1230 and 1730 for babbitt.

Breakdown Tests.

In order to observe the performance of the bearings under extraordinarily heavy loads, breakdown tests were run on each type of bearing with only one section of shafting, on which were four bearings. This small number of bearings was used because it was impracticable to keep close watch of a larger number of bearings and avoid trouble during the excessively severe conditions. The maximum load was 600 lb. on the scales, or about 5000 lb. per bearing.

The speed of 200 r.p.m. was chosen because it represents about the average lineshaft speed in practice. These tests began at about 3200 lb. per bearing. Failure occurred at about 4250 lb. per bearing in the case of the babbitt, 4650 lb. in the case of the ball bearings, and about 5100 lb. in the case of the roller bearings. The quality and amount of lubricant used undoubtedly have an important effect upon the load that will cause a given bearing to fail.

The bearings did not in any case "fail" structurally, as the power was cut off soon after distress was manifested, but the failure was simply that of the lubricant. Breaking down of the lubricant results in an immediate increase of the power required to maintain the original speed of rotation of the shaft in the bearings. In each case probably only one of the four bearings used in the breakdown tests showed distress at any one time. In the case of ball bearings, this was evident, as distress was manifested by disintegration of the grease which "melted" and ran out of the bearing. This was accompanied by an immediate increase in power requirement. The temperatures given (99 deg.-117 deg., etc.) indicate the averages for the four bearings being tested. Similar behavior on the part of the babbitt and the roller bearings indicated that at least one of the four under test was suffering from an approach to "metal-to-metal" contact. The bearings were not injured by these endurance tests, and all were used in subsequent tests at the more usual speeds and pressures.

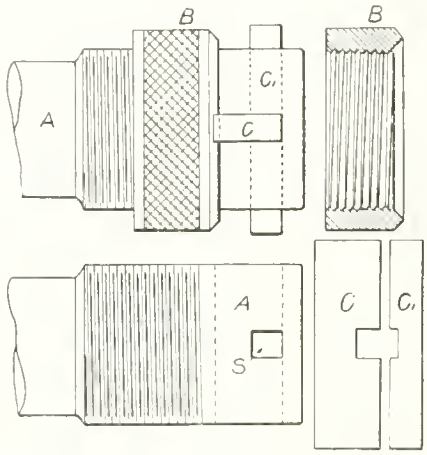
Table 1.—Relative Amounts of Power Consumed in Friction.

Bearings.	100 Ft. Per Min. 77 Deg.	100 Ft. Per Min. 100 Deg.	300 Ft. Per Min. 77 Deg.	300 Ft. Per Min. 100 Deg.
Ball	1	1	1	1
Roller	2.2	2.5	2.7	3
Babbitt	3	3.6	4.5	4

SELF-SETTING CUTTER BAR.

By H. Womersley.

The accompanying figure shows a self-setting cutter holder which has the advantage of carrying a number of cutting tools that can be quickly changed for a set of a different size. The cutters (C) and (C_1) are made to fit each other at right angles as shown. Slots to receive them are cut in the bar (A) which is also threaded to take the knurled nut (B).



SELF-SETTING CUTTER BAR.

The cutters are located by the slots in the bar and also by the V-shaped edge of the clamping nut fitting into corresponding Vees in the large cutter. The cutters are finish-turned and ground while in the bar, and marked so that they will always true up when the nut (B) is tightened upon them.

Improved Tungsten Lamps.—The arc lamp is evidently to be superseded shortly by a greatly improved tungsten filament incandescent lamp. Instead of attempting to work the filament in a perfect vacuum, the globe, after exhausting, is refilled with pure nitrogen at atmospheric pressure. This allows the filament to be operated at a much higher temperature than is possible with the vacuum without injury to and blackening of the globe. The efficiency of the lamp increases very rapidly at these high temperatures and, in the experiments thus far tried, a candle power has been obtained per .5 watt as compared with 1.25 watts per candle of the ordinary tungsten lamp. This type of lamp has been found to be best suited for powers of from 1,000 to 6,000 c.p., but it is claimed that all tungsten lamps will give much better service with nitrogen than with a vacuum.

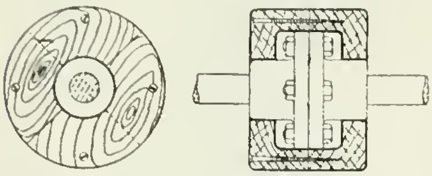
Vancouver, B.C.—The General Fire Extinguisher Co. is considering erecting a large factory here.

Safety Provisions Relative to Transmission Machinery—II.

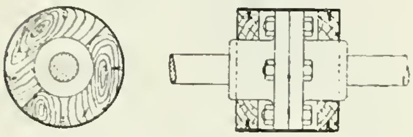
By W. Sydney Smith.

An official report by the Inspector for Dangerous Trades in England, regarding fencing and safety precautions for transmission machinery, has been issued. It explains the structural and administrative safeguards with regard to the several parts of transmission machinery which experience shows to be needed for the protection of persons employed where such machinery is used.

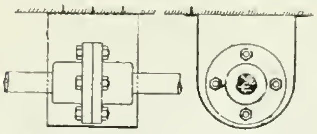
CONCERNING couplings, the report says that such projections as bolt heads, nuts, screws and keys should be prohibited in all new installations of



Wood discs in halves screwed together.



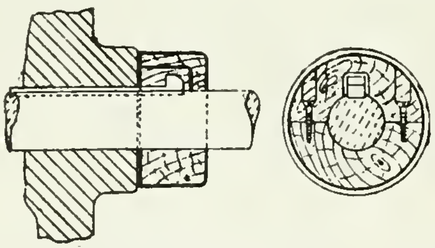
Sheet metal bands screwed to wood discs.



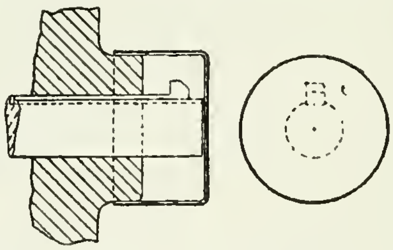
Sheet metal band screwed to ceiling.

FIG. 6. FENCING FOR PROJECTING BOLTS OF SHAFT COUPLINGS.

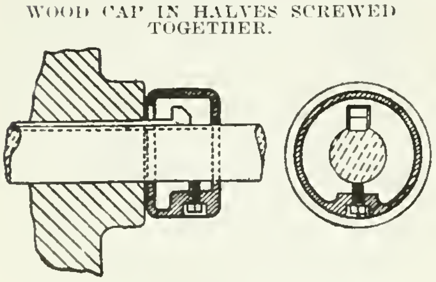
transmission machinery. Shaft couplings should be constructed with countersunk bolts and nuts, shrouded flanges, or other equally safe devices. In existing installations, as shaft couplings are generally situated near bearings, all projections should be covered by smooth wood or metal casings if the shafting is ever approached whilst in motion. Various methods of fencing projecting coupling bolts as shown in Fig. 6.



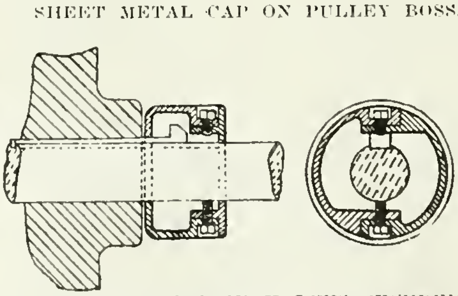
WOOD CAP IN HALVES SCREWED TOGETHER.



SHEET METAL CAP ON PULLEY BOSS.



CAST IRON CAP WITH COUNTER-SUNK SCREW.



CAST IRON CAP IN HALVES SECURED WITH COUNTERSUNK SCREWS.

FIG. 7. GUARDS FOR PROJECTING KEY HEADS OF SHAFT COUPLINGS.

Collars.

Projecting set-screws on shaft collars should be prohibited on all new installa-

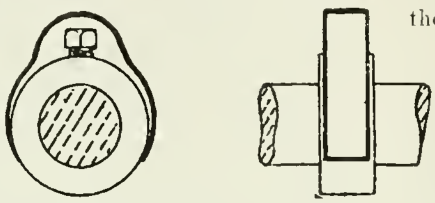


FIG. 8. STEEL CLIP GUARD FOR PROJECTING SET SCREW OF SHAFT COLLAR.

tions. Countersunk set-screws or other equally safe method of attachment should be provided. On existing installations of transmission machinery, as collars are always situated in close proximity to bearings and loose pulleys, projecting set-screws should be removed, replaced by countersunk set-screws, or covered with a smooth cap or guard if the shafting is ever approached whilst in motion. Figs. 8 and 9 show types of guards.

Wheels, Drums, Pulleys.

All appliances of this nature if less than 6½ ft. from the floor level or any place to which the workers have occasional access, should be fenced so securely as to prevent accidental contact by persons with parts in motion, but appointed persons, such as enginemen, oilers, and beltmen, may be allowed to approach unfenced drums and pulleys for the necessary work of manipulating driving belts and ropes at times when the speed of the shafting and pulleys

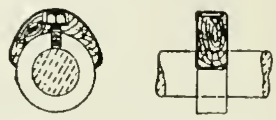


FIG. 9. WOOD GUARD FOR PROJECTING SET SCREW OF SHAFT COLLAR.

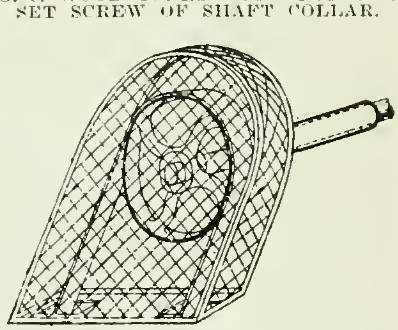


FIG. 10. WIRE NETTING GUARD FOR BELT AND PULLEY.

does not exceed 6 revolutions per minute if adequate provision is made for prompt stoppage of such parts at the first sign of danger. Gear wheels, if situated as above, should be encased with metal guards fully protecting the teeth and rims with a portion of the guard hinged or sliding to facilitate lubrication of the teeth.

Partial guards for gear wheels are always inadequate, and may even be dangerous; though the ingathering teeth may be protected, additional points of danger are introduced between the teeth and the ends of the guard, and fingers, clothing, or cleaning rags may easily be caught unless the teeth are wholly covered. Complete guards, enclosing the whole of the wheels, have the advantage of preventing access of dust and also limit the splashing of grease. For these reasons gear wheels on overhead line shafting are generally completely fenced.

Sprocket wheels for chain drives should be fenced like gear wheels, if similarly accessible. Friction gearing is equally dangerous as toothed gearing at the intaking parts, but guard rails are generally sufficient for this type of transmission machinery if the fence be

maintained in such position that the space between rails and dangerous parts cannot be entered by the workers.

The type of fencing for drums and pulleys is often determined by their position and the direction of the driving bands and ropes; the guards may generally be so arranged as to include fencing for both pulleys and bands, Fig. 10. Fast pulleys near the floor level are dangerous owing to the risk of clothing and feet becoming entangled between belt and pulley. These should be protected by guards, which should also fence the loose pulleys and driving belts. Fenders of wood or metal form satisfactory fences for pulleys in such positions. Guard rails are often so used; sheet metal, wire netting or perforated metal being added according to special circumstances where the pulleys are more exposed or greater danger exists owing to the employment of females.

Methods of Solving the Problem of Foundry Help

By Arthur Smith

The effects on the general efficiency of any particular body of foundry operatives which the allocation of the best work to one or two men, and the lack of consideration for apprentices brings about are, together with the "handy man" feature, discussed in a practical and telling manner in the following article.

In a foundry the help question is often one of a serious nature, and many of the foremost foundry managers of to-day owe their success to the scientific solution of this problem.

Invariably the most skilled moulders congregate in or near large cities. The principal reason for this, besides the lure of city pleasures, no doubt is that labor organizations are more strongly intrenched in the larger centres, and the workman consequently commands a higher wage for his services. While the foundryman in the city may select his men from among the cream of the trade, his less fortunate brother in the smaller town must content himself with the help that filters through the sieve of the metropolitan foreman, or develop his help along lines peculiar to himself.

How often does one go into a shop on the outskirts and find that the best jobs are saved for one or two star moulders, while their fellow workmen look with envious eyes upon certain patterns that they are never allowed to place in the sand. During slack times no hardship is experienced from this method of working, but when business becomes brisk and customers demand castings on short notice, the foreman who has allowed his tedious work to repose in the hands of one or two skilled moulders is in a serious predicament. At such times the star moulders are inclined to become just a little bit conscious of their responsibility, and jobs, instead of moving faster, may go more slowly on account of more importance being attached by these experts to the doing of the work than to getting it out.

Training Apprentices.

The old adage: "In time of peace prepare for war," may be applied to advantage in foundry practice. The foreman who, in quiet times, instead of bemoaning his decreased tonnage, endeavors to so build up his organization that he may not be caught napping when the rush comes, earns ultimate success. There are several ways of accomplishing this. Some foremen resort to the method of developing a greater number of apprentices, when such are available: the training of whom is an art in itself. Many a bright boy, who would eventually become a first-class mechanic and a credit to the trade, is driven from the shop for some youthful prank, the foreman evidently expecting a boy of fifteen to have the dignity and poise of a man. Again, the boy may be placed with a man who is known to be crabbed and disagreeable, and the apprentice finds it impossible to satisfy him. The boy though ill-treated, fears to complain, and if complaint be made by the moulder, the lad is often sent packing without any effort being made to ascertain whether he is not more sinned against than sinning.

There are, alas, too many moulders who have evidently forgotten that they were once obliged to serve an apprenticeship. Instead of assisting a youth placed with them, they endeavor to keep his efforts strictly applied to manual labor. The apprentice's duties under these conditions, consist of shoveling, hunting gaggers, wheeling facing, etc., and when the mould is finally rammed, he must stand idly by while the moulder proceeds to finish the creation of his skill. The boy must not put a tool to the mould, though if his superior be more kindly disposed he may be allowed to rub on the lead. Is it any wonder that boys are often out of their time for several years before they acquire any finished skill in their chosen occupation.

A certain foundry manager in one of the largest shops in the United States has evolved a novel plan for training foundry apprentices that has been very successful. After an apprentice has been in the shop for about a year, he is given a floor and put strictly upon his own merits, with simple work. A short time later, an entirely green apprentice is taken in and placed with the boy having a year's experience. They work together for a while and as the older boy becomes more proficient he is graduated to another class and a second green boy brought in and placed with the one who has just been left alone. By this system the boys are being developed continuously, and by placing them upon their own resources at an early period of their apprenticeship, they become more self-reliant and eventually become skilled mechanics. Of course this manager draws some blanks. In fact the percentage of boys finally surviving the ordeal is relatively small, but, after all, results count.

Developing Unskilled Labor.

It often happens in these strenuous times that foundry apprentices are very rare. The textile mills, garages, machine shops, etc., claim many of them, and, in fact, the foundry seems one of the least desirable of the many openings for young men. To offset this, foundrymen are turning their thoughts to the development of "handy men," and it is remarkable what success is being achieved along these lines. There are in nearly every foundry, certain laborers who, either through lack of opportunity or neglect have not in their boyhood days acquired a trade. They have now passed their early youth and look grimly into a sordid future at laborer's wages. This class of men respond readily to the foundryman who is endeavoring to develop moulders by rapid stages. It is true that these men rarely become the most skilful in the shop, though there are cases where they rank among the best, and for certain lines of work they are unexcelled.

The usual method of development is as follows: A bright laborer is placed with a moulder, preferably a friend or relative if possible, and given every opportunity of showing any ability he may possess. Sometimes the process is very slow, and it may be a year before the laborer is capable of assuming any responsibility, but eventually he finds himself.

The man, if at all human, appreciates what has been done for him, and remains faithful to the one who has given him his chance. The foreman does not fear of his leaving to accept another job, for, while he is a valuable man where he is, his qualifications are not so general that he would be sought for by a rival foundry.

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

A FEW USEFUL DRILL JIGS.

By W. G.

THE jigs herewith illustrated are of very simple construction, and are especially intended for use in cases where the number of components to be

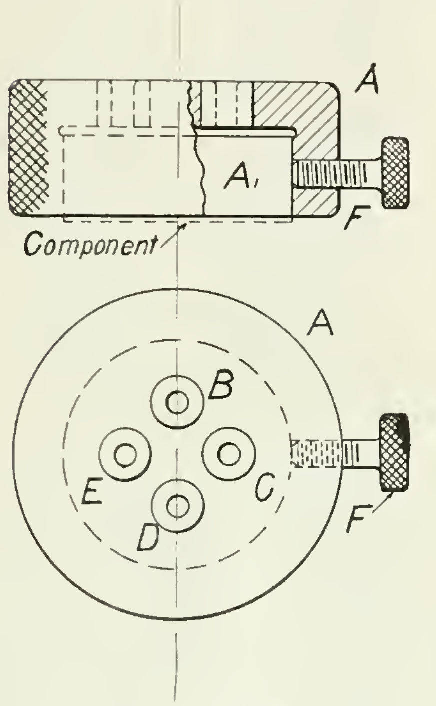


FIG 1. JIG FOR SCREWING DIES.

machined is small and the question of outlay is to be considered.

Fig. 1 is part sectional elevation and plan of a simple form of plate jig for drilling the clearance holes in screwing dies (flat-circular). Part (A) is the body. This consists of a circular knurled mild steel blank, in the centre of which is formed a recess (A) for the purpose of receiving and locating the component. It is essential, however, that the said recess should be of such a depth as to allow the component to stand clear of the jig face, as shown; thus in each case the base of the component becomes the drilling face, and any injury to that of the jig will not in any way impair the results.

The upper part of the body is provided with four drill bushes (B), (C), (D) and (E). These should be of best cast steel, hardened and ground, and should be made a driving fit for the holes in the body. Part (F) is the clamping screw. This is preferably made from mild steel, and should be case hardened at the extreme end in order to prevent burring.

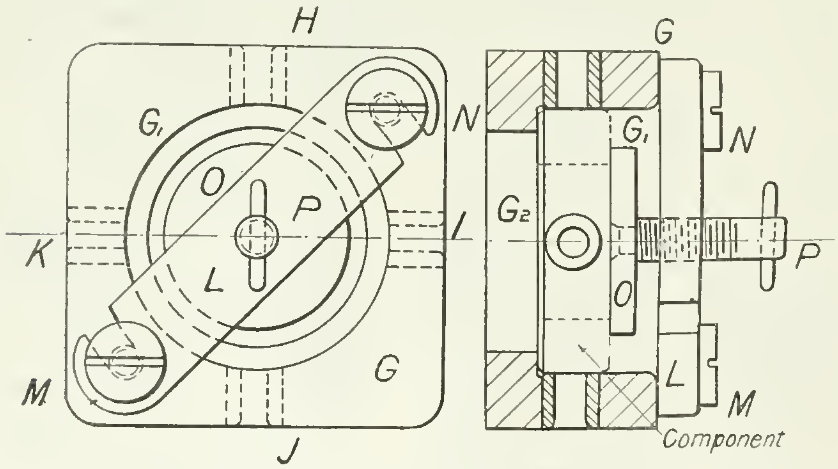


FIG. 2. JIG FOR DRILLING ADJUSTING NUTS.

Fig. 2 is a front view and part sectional side view of a jig for drilling the "tommy" holes in circular adjusting nuts. The body (G) consists of a cast iron block of square section, in the face of which is formed a circular recess (G^1) for the purpose of locating the work. It is also provided at its opposite face with a clearance hole (G^2), the object of the latter being to facilitate the removal of chips, etc.

Parts (H), (I), (J) and (K) are the drill bushes. These should be hardened and ground, and a tight fit to the holes in the jig body. The detachable latch (L) is preferably made from "black" (unmachined) mild steel, and does not require any machining beyond the cutting of the end slots and the drilling and tapping of the clamping screw hole. Parts (M) and (N) are the supporting pins for the aforesaid latch. Parts (O) and (P) are the clamping plate and screw respectively. The former is secured to the latter by riveting, as shown.

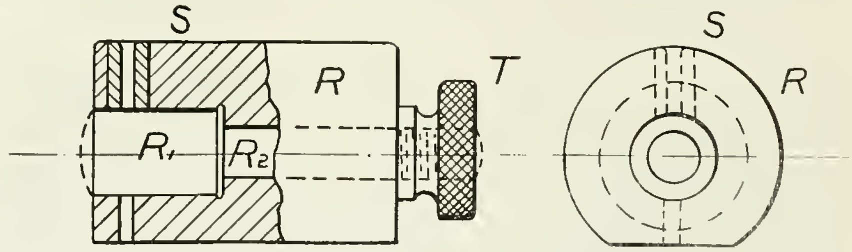


FIG. 3. PEG HOLE JIG.

The sequence of operations is as follows:—The component is first passed into the locating recess (G^1). The detachable latch (L) (carrying clamping plate and screw) is next secured to the cheese head pins (M) and (N). A turn of the clamping screw (P) finally secures component and latch in their respective positions for work.

Fig. 3 is part longitudinal section and end view of a peg hole jig for circular-headed set-pins. The body (R) is made from circular mild steel bar. It is advisable, however, that the whole of the machining (except flat and bush hole) should be performed at the same lathe setting. The hole (R^1) is the locating hole, and this should be bored quite true; the other (R^2) is simply for the purpose of clearance, and need only be drilled. Parts (S) and (T) are the drill bush and thumb nut respectively. The latter consists of the usual type of knurled thumb-nut tapped out of corresponding pitch to that of the component.

It will be noticed that the over-all length of the jig is less than that of the component, thus allowing sufficient overlap of the latter for the purpose of securing it to the jig body by means of the thumb-nut (T), as shown.

SOME SIMPLE BORING TOOLS.

By H. Womersley.

FIG. I. represents a cheap and very easily made boring head. It can be of any size desired and is very useful for the turret lathe. The body (B) can be

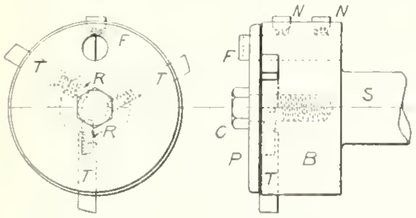


FIG. 1. BORING AND FACING TOOL.

of cast iron with slots planed in its face to take the three tools (T) which may be of high-grade steel. The tools are tapped at the back for set screws (R) as shown, for the purpose of adjustment; and all are securely held in place by the plate (P) and the cap screw (C). The placing of the cutter (F) shows how this head can easily be arranged for facing. More of these may be inserted if desired. The cutters can be ground in the machine or with the help of a sliding gauge. This head is useful for finish boring rough holes where no great degree of refinement is required.

Finish Boring Head.

The boring head shown in Fig. 2 is one that can be made in a very short time

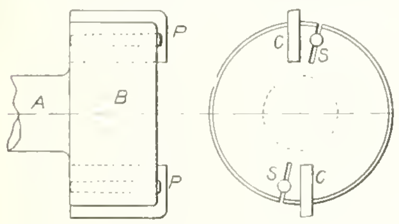


FIG. 2. FINISH BORING HEAD.

and with little expense. The body (B) and shank (A) are of machine steel to suit drill press, turret head or even the lathe tail stock. Holes are first drilled and taper reamed to take the standard taper pins (P) which hold the cutters (C) in place. These cutters can be ground with square corners or with any sized fillet as shown. This appliance is particularly useful as a cheap finishing tool for both boring and bottom facing.

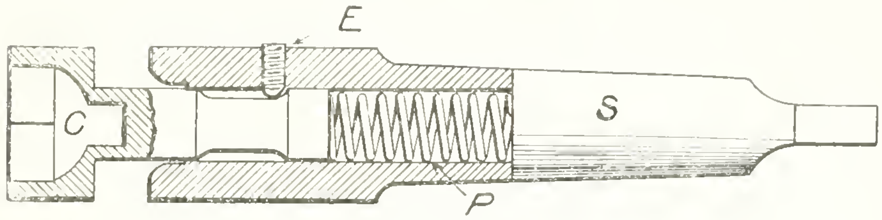
NUT-RUNNING ATTACHMENT.

By Wm. Gibbs.

WHEN a piece of work requires the placing of a large number of bolts, the time consumed in screwing on the nuts often makes this the most expensive operation involved, and any means of eliminating more or less, this tedious operation is a welcome addition to the organization.

In the illustration is shown a self-releasing nut-runner of very simple design and very effective in operation. It consists of the Morse tapered shank (S) which is bored out to take the spring (P) and the nut chuck (C) which is free to slide in and out, but not to rotate in the shank. The socket (C) is made of tool steel and is hardened, while the shank may be of mild steel. The tool can be applied to different styles and sizes of nuts by simply backing off the set screw (E), removing the chuck and substituting the one desired.

The appliance complete may be driven by a suitable chuck attached to a flexible shaft, or for work not heavy or bulky, it can be set up in the drill press and the work moved under it. After starting the nut by hand, the socket (C) is placed



NUT RUNNING ATTACHMENT.

over it while in motion. When the nut is tightened down hard, the chuck rises up off it against the pressure of the spring and is ready to be applied to the next; the tightness to which the nut is screwed depending, of course, upon the tension of the spring. The above device has been in continuous use for a long time and is giving perfect satisfaction.

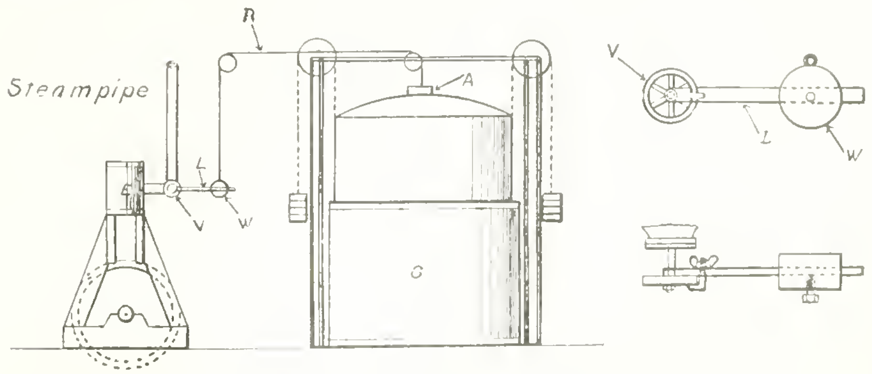
REGULATING DEVICE FOR GAS PRODUCERS.

By R. Bell.

IN connection with gas plants using pressure producers, it is necessary to regulate the speed of the blowers by some means so that the producers supply approximately the amount of gas required by the engines. If this be not done automatically, a constant watch must be kept on the gasometer to prevent it getting too high or too low, especially when a fluctuating load is being carried. If the holder should rise too high, the gas will blow out beneath it and the dangerous nature of this poisonous gas in a building or closed space cannot be over-estimated. On the other hand, I have seen the top of a large gasometer crushed in by the suction of an engine when allowed to go down to the bottom. The accompanying sketch illustrates an extremely simple method of regulation which has been used with great success.

In the above arrangement of the gasometer and blower engine, a lever (L) is attached to the steam valve (V). This lever is connected through the flexible wire rope (R) to a weight (A) on the tank as shown. The counterweight (W) is lighter than (A) but is sufficient to overcome the friction of the valve spindle packing and keep the rope (R) tight. As the holder goes down with a heavy draft of gas, the lever (L) rises, opening the throttle and speeding up the blower engine. Likewise, if the holder rises, the steam is cut off and the blower slows down. The weight (A) is not fastened rigidly to the holder so that there is no danger of breaking the rope by an excessive fall of the gasometer, the weight (A) simply remaining suspended by the cord.

In the second half of the figure is shown the means of fastening the lever to the hand wheel. A hole is drilled in the end of the lever for the valve spindle and another to take the hook bolt clamp



REGULATING DEVICE FOR GAS PRODUCERS.

as shown. When starting up or slowing down the engine, the lever is disengaged by loosening the wing nut and opening

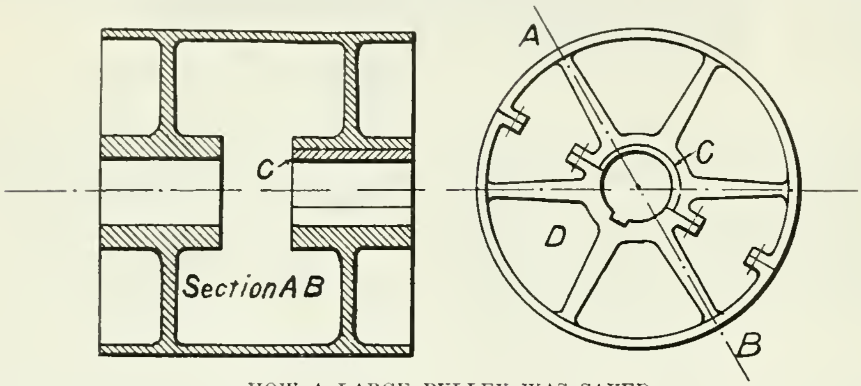
or closing the valve by hand. When the best working speed is attained, it is only necessary to tighten up the wing nut with the lever in the proper position.

HOW A LARGE PULLEY WAS SAVED.

By J. D. Y.

THE pulley referred to was 8 ft. in diameter, with a 4-ft. face, being intended for two 24-in. belts. It was made of cast iron in two sections bolted together, as shown in the sketch. All the machine work had been done except the boring of the hub, when it was discovered that the bore in one of the sections would not clean up.

To increase the bore and bush it was at first considered the only way out, when the thought occurred, why not bush the imperfect half only? This was done. Section (D) was moved out of the way, and the other half bored to take the half bushing, as shown. The bushing was fastened by four small pins, and the key-way cut in the solid half of the wheel. The pulley has been in operation for some considerable time now, and is giving complete satisfaction.



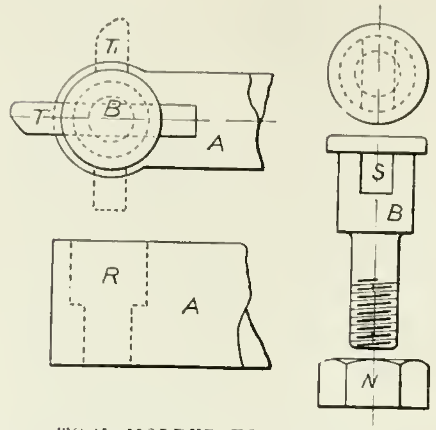
HOW A LARGE PULLEY WAS SAVED.

HEAVY ADJUSTABLE TOOL HOLDER.

By H. Womersley.

THE accompanying sketch is of a more or less common but very handy tool-holder for heavy work, and can be used either on the planer or lathe. It consists of the bar or shank (A), which may be of any size desired. It is jumped up on the end and drilled at (R) to take the clamping screw (B), shown. The clamping screw is slotted under the head at (S) to take a tool (T) of the desired size. The tool is slipped through the slot, and is held in place at any angle by tightening the nut (N).

For planer work this tool-holder is best used upside down, with the tool trailing, to prevent digging in, also the shank (A) usually has a number of grooves milled in its face to fit the tool and hold it firmly in its different positions.—Ed.



TOOL HOLDER FOR PLANER

BORING BAR FOR MILLING MACHINE.

By Armley Leeds.

IN all kinds of jig making where there occurs the necessity of boring holes at exact centres, the milling machine fitted with a suitable boring bar is a primary requisite. A very suitable tool for this purpose is shown in the accompanying cut.

The arrangement consists of the shank (S) provided with the nut (N) for the purpose of withdrawing it from the spindle of the machine. The outer end is bored and tapped at (O) as shown, to receive the bar (B) which is threaded right or left hand according to the direction in which it is desired to run the machine.

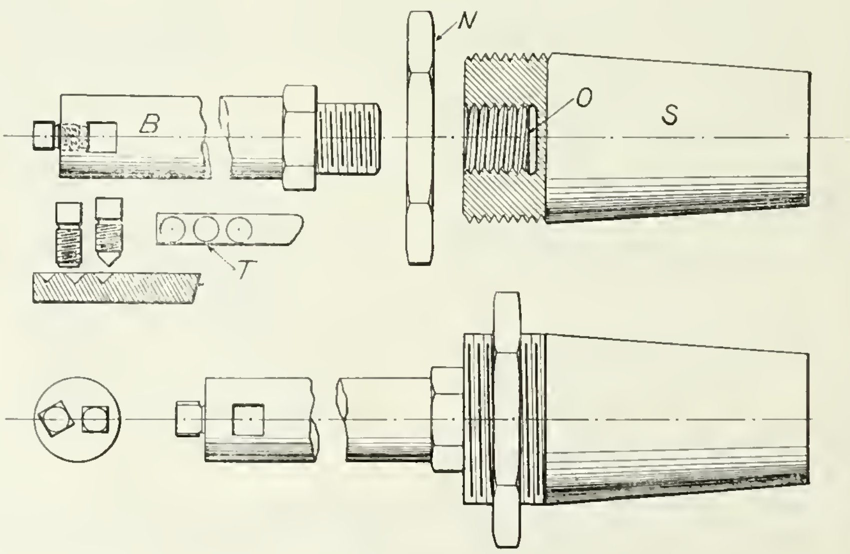
The bar proper (B) besides being slotted to take the square tool (T), is drilled and tapped in the end to take the two set screws as shown. These set screws are made of tool steel and the points are hardened. It will be noticed that the point of one is turned flat and the other is pointed. The tool itself is countersunk at intervals to fit the nose of the pointed set screw. This allows of a fairly fine lateral adjustment of the tool. To move the tool out a little, the flat screw is loosened and the pointed one screwed down. When the pointed set screw has bottomed, it is only necessary to interchange the screws and the adjustment can be continued for a considerable range. Care is necessary in screwing down the set screws, as very little pressure is necessary to hold the tool firmly, and too much will spoil the threads of the screws.

Question.—What would be the amount of iron required for a certain casting? The pattern, 20 per cent. of which represents cores and prints, is white pine and weighs 15 pounds.

Answer.—$100\% - 20\% = 80\% = \frac{80}{100}$

Ratio of white pine to iron is 13 to 1.

Weight of iron, therefore, is $\frac{80}{100}$ of $15 \times 13 = 156$ pounds approximately.



BORING BAR FOR MILLING MACHINE.

Elements of Power Transmission -- The Belting Feature

By J. Pedie Sanderson, B.A.Sc.

The necessity of a fully competent man to supervise the care of belts is often one of the things about a plant that are so obvious as to be little thought of. Like the engineer who is asked: "Can you start an engine?" and the fireman who is hired for his ability to transfer coal, this man's necessary qualifications are often fulfilled by an affirmative answer to the question: "Can ye fix belts?"

In spite of the many improvements recently made in electrical transmission and the great advances achieved in other forms of power transmitting mediums, belt drives are still the most suitable for a fairly wide range of conditions, and their apparent simplicity is inclined to cause their popularity to remain with engineers for an indefinite period of time.

The initial cost of a belt transmission is about one-fourth that of an electrical transmission where the conditions are suitable for the former system, but where the drive is such as to cause more or less rapid deterioration of the belt material, the balance of favor goes to the electrical drive. A leather belt drive costs nearly twice as much as a rope drive, and more where large powers are to be handled for considerable distances. Rope drives, however, unless great care is exercised in their construction are very much less economical.

Rope Drive Comparisons.

As the ropes wear they become uneven in diameter and some parts fall more deeply into the V-shaped grooves of the sheaves than others, causing different speeds in different sections of the rope. This sets up a sort of differential drive which causes a difference in rope tension and may even cause some ropes to be tighter on the slack side than on the intended tight side of the drive, and consequently producing negative work. Leather belts can be efficiently spliced much more easily than cotton or rubber belts, and the splicing up of a rope drive is a very considerable undertaking in comparison.

Abuse of Belts.

The value of a belt transmission rests in its durability and efficiency, two qualities almost entirely at the mercy of the treatment which is accorded it. A particular case came to the writer's notice about ten years ago. A three-inch leather belt was placed upon the cone pulley drive of a lathe and, on account of poor alignment and rough usage, had to be replaced with a new one in less than six weeks. Before the new one was put on, however, the pulleys and shafts were correctly lined up with the result that it is still running and rendering good daily service.

The strangest feature in connection with the supervision of belting considering its importance to the continuous and efficient operation of machinery is the fact that, in a great majority of plants, its care is either entrusted to no man in particular, or to some one who has been found to be unsuited for anything else. How often one sees an important drive made up of from three to six pieces of belting of various ages and thicknesses fastened together with leather lacing, wire, and perhaps a number of patent metallic fasteners. The operator in many cases, patches or fixes his belts with whatever he can get, and gives them no further thought as long as his machine keeps going. He rarely has more than a rudimentary knowledge of this class of work.

Belting Organization.

The belting of a plant, no matter how extensive, should be placed in charge of one man, preferably one who has gained his experience in a factory where belts are made, and who with his understudy should in company with others connected with machinery maintenance, be under the direction of the chief engineer or master mechanic. It is only in this way, and seeing that the belt man does his work, that dependable records of belt performances can be kept and efficient systems of inspection be carried out.

Tension Measuring Machines.

By far the most important point in connection with the care of belts is tension properly set and maintained. There have recently been devised and placed on the market several appliances for accurately measuring the tension of belts. One of these is the belt bench which is provided with spring balances and other requisites so that belts can be periodically removed from their machines and be brought to the bench for inspection and repairs, and have their tensions weighed. This is to be advised where the number of belts will warrant the expense, although a great deal can be accomplished by an intelligent man without its use. To supplement the use of the bench, which is limited in its application, there has also been perfected a portable device for measuring the tensions of non-removable belts while in place. As this is applicable only to small belts, and is rather inconvenient to use in some belt situations, it has not, so far, proved very useful.

Proper Tension.

The most suitable tension of a belt is an extremely variable quantity. It should be adapted to its position and to the work required of the belt. The less the tension can be made within reasonable limits without causing slipping, the longer will be the working life of the drive. The experience and judgment of a man suitable for this work has, so far, been found to be the best authority for setting belt tensions.

Belts should be made endless; that is, lapped and cemented together whenever possible. In smaller ones, it is often necessary for convenience in caring for them to have one inferior joint in its length, but there is no excuse for more. This joint should be intelligently made with leather lacing of the proper proportions. Patent metallic fastening devices should be used with caution as a number of them have been found to be worse than useless.

Stretch.

The average leather belt stretches from 6 to 8 per cent. of its original length during its lifetime, and most of this takes place during the first six or eight months of its active use. After this, the stretch is small and uniform until all elasticity is lost.

The method of procedure then for a moderately large belt would be to cut it from a foot to three feet too short, depending upon its size and length. It is then laced up with a carefully made patch which can be periodically shortened until the greater part of the stretching process is finished. A permanent patch is now cemented in and the drive will require attention only at long intervals of time thereafter.

It is well known that a lapped and cemented joint will last more than twice as long as any other, besides running more smoothly and in fact, it can be made as strong as the body of the belt. When the simplicity of making a first-class cemented joint is known it is surprising that it is not more generally used. The requisite tools are comparatively few and inexpensive, as it is possible for an intelligent man to make most of them for himself.

Cementing a Joint.

Before cementing a joint, the belt should be placed over the pulleys and the proper tension obtained by means of

clamps. Care must be observed to fasten these clamps squarely across the belt and to locate them centrally with it before drawing them up with the threaded rods along the sides. After drawing the belt a little tighter than is desired to allow for slack, place a smooth board under it between the rods and bevel the ends to form the lap. Apply the cement while very hot, but not boiling, and not too thick, rubbing it in thoroughly. On large belts, it is better to cement a few inches at a time, rubbing and hammering each part down by itself, and so proceeding until the joint is completed. The clamps should remain in position for at least an hour or as long as convenient. Small and medium-sized belts can be readily clamped with C clamps between two smooth boards to which they have been tacked in the proper position. The length of the lap should vary with the width of the belt, general practice being given in the folowing figures:—

Belt widths in inches....2 3 4 5 6 7 8
Length of lap in inches..5 6 6 7 8 8 9

For widths of 9 inches to 18 inches, the lap is made equal to the belt width. Above 18 inches, the length of the lap need not be greater than this.

Direction of Lap.

The direction of the lap should be such that, in a single belt, the leading edge of the lap should be on the inside or next the pulley. In a double-ply belt, the same rule applies with regard to the outer layer. The trailing edge of the inner ply, however, should be next the pulley which gives the joint the form of a broken V with the vertex pointing in the direction in which the belt is intended to travel.

Friction is much greater between similar than between dissimilar substances, hence much is to be gained by covering pulleys with leather. This allows a greater horse-power to be transmitted without increasing the tension of the belt, as well as to greatly reduce the tension necessary to transmit a given horse-power. To cover a pulley with leather, make the covering in the form of an endless ring whose circumference is about 1/8 inch to the foot less than the circumference of the pulley. Clean the surfaces of all grease by washing with benzine, naphtha or similar substance. Start the pulley into the ring and cover with a special glue both the inside surface of the ring and the exposed surface of the pulley. Quickly drive the cover over the pulley by lifting it, and striking the cover edges against the bench or floor. When in place, rub the cover thoroughly with a smooth hardwood stick or hammer handle to insure perfect contact, particularly around the edges. If properly done, no pinning is required although it is customary to insert a few copper rivets.

Choice of Belts.

Narrow, thick belts are much more desirable than wide thin ones, especially for long drives. According to Mr. F. W. Taylor, whose experiments cover a continuous period of over nine years, it is advisable to use double belts on pulleys 12 inches or over in diameter and triple belts on pulleys 20 inches or over. This is for the purpose of giving a sufficient stiffness to prevent snapping and waving on the slack side when running at high speeds which is often more injurious than the actual work the belt has to do. This stiffness should also be sufficient to prevent side travel which becomes excessive when belts are long and the load variable.

Belt Calculations.

The satisfaction of belt drives is greatly increased by their proper proportioning.

To find the width of belt necessary when the horse-power required to be transmitted is known.

Multiply the horse-power by 33,000 and divide this product by the product of the belt speed in feet per minute multiplied by 55 for single, 83 for double or 110 for three-ply belts.

The constant 55 depends upon the arc of contact of the belt on the pulley and varies greatly according to different authorities, that is, all the way from 30 to 65. The above, however, is a reliable figure and is for cases where the arc of contact is approximately half of the pulley. When the arc of contact is not 180 degs., the "effective pull" can be found by multiplying the arc of contact by 55 and dividing the product by 180. Multiply this by 1.6 for double belts and by 2 for triple belts.

Inspection.

The belt man should carry out careful and systematic inspections of all belting at frequent intervals and keep a record of his work. Inspection should be such as to determine if any of the following conditions exist:—

(1)—Whether belting is over-dry or saturated with oil.

(2)—If any laps have begun to open.

(3)—Whether belting is working under proper tension.

(4)—Whether shafting is in line or if a guide has to be used to keep belts on the pulleys.

(5)—Whether afflicted with an overdose of dressing.

General.

Greasy or unduly dry belts should be thoroughly cleaned, the former with naphtha or benzine if necessary, and the latter may have to be scraped free of surface dirt. When a clean surface is obtained, both sides should receive a light coat of approved dressing. These applications should be repeated judiciously until that mellow but not greasy feeling characteristic of proper working condition is obtained.

If laps have begun to open, they should first be thoroughly cleaned with some degreasing substance such as naphtha and re-cemented, not tacked or riveted. If shafting be out of line, the sooner it is fixed the better for the machine as well as the belt. The tightness with which belts are put on pulleys is of fundamental importance not only to the belt but to the bearings that carry it. Improper tensions should be promptly re-adjusted to the least that will satisfactorily transmit without slipping the full load required of the belt. The use of rosin, soap or even an overdose of good dressing is to be rigorously avoided. If a belt will not do the work required of it without such destructive encouragement, it should be replaced by one of the proper dimensions.

All electric motors, engine drives and the like where large belts are used should be so mounted that the centre to centre distances between the shafts can be adjusted to give the proper tension to the belts, or in cases where this cannot be done, an idler pulley should be hung and weighted so that the most suitable belt tension will be constantly maintained.

The labor involved in caring for belts cannot reasonably be placed in the "unproductive" class any more than the capital invested in the belts themselves, for the one is vital to the efficient working of the other. The condition of a belt hanging down and the machine operative waiting for the belt man to turn up is one that could not exist with a properly regulated belt department. This saving alone coupled with the prevention of the loss due to slipping belts, to say nothing of the saving in capital investment, would make it a profitable matter to pay the belt man a very good salary.

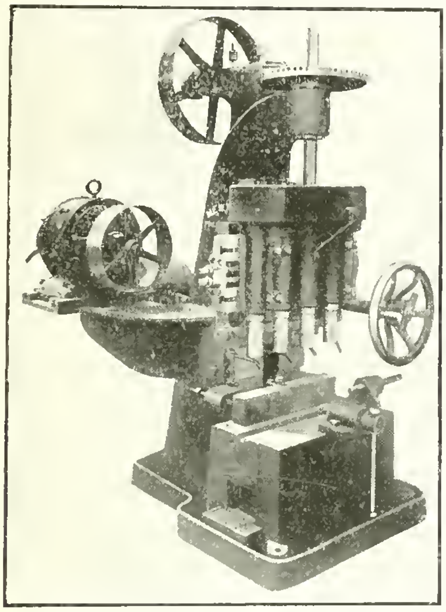
Internal Combustion Marine Engines.—A number of hints to Canadian manufacturers are contained in reports received this week by the Trade and Commerce Department from its commissioners in different lands. Why Canada is losing the New Zealand trade in internal combustion marine engines is pointed out by Commissioner W. A. Beddoe from New Zealand. The high price, ancient standard and inapt construction of the Canadian engines is given as the cause. Canada has a big advantage over the United States in the matter of tariff, yet the American engine is landed cheaper than the Canadian one, and another objection to the latter is that it is too heavy in construction.

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

NEW RAIL DRILLING MACHINE.

THE rail drilling machine shown in the illustration possesses some new and interesting features. The three holes for the fish-plate bolts and the



NEWTON RAIL-DRILLING MACHINE.

hole for the rail bond are all drilled at the same time. The three right-hand spindles are for the bolt holes, and these are arranged so that the distance between centres of the holes can be adjusted from 3½ to 9 inches. The left-hand spindle is for the rail-bond hole: it keeps a constant distance of 6 inches from the last bolt hole. All the spindles are mounted on a saddle and can be moved vertically in unison. The saddle is counter-weighted and has two changes of power feed in addition to hand adjustment. The machine is made by the Newton Machine Tool Works, Philadelphia, and a 10-h.p. Westinghouse electric direct current motor furnishes the power.

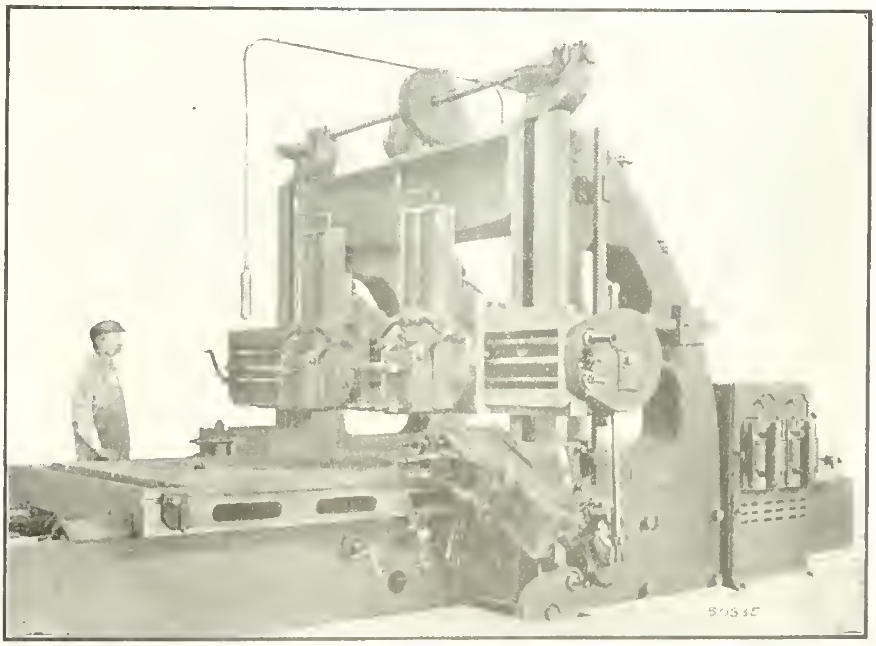
POND PLANERS AT COMMONWEALTH STEEL CO. PLANT.

POND heavy planers for work 120 in. wide and 72 in. high, 96 in. wide and 72 in. high, 86 in. wide and 48 in. high, all to plane 18 ft. long, and each constructed with two heads on cross-rail and one side head on each upright, have recently been built for the Commonwealth Steel Co., of St. Louis, at the Pond Works, of Niles-Bement-Pond Co. These planers are constructed for severest duty on steel castings, requiring the strongest, heaviest and most accurate construction. All gears are steel castings or steel forgings and all bearings are bronze lined with ample provision for lubrication. All the gearing, shafts and bearings are of heavy, substantial construction, and all wearing surfaces are proportioned for long and efficient service.

The illustration shows one of the 86 in. wide by 48 in. high by 18 ft. long planers. This is one of 29 planers used by the Commonwealth Steel Co., for machining the open hearth cast steel combined double body bolsters and platforms, which enter into the underframe construction for passenger cars, and are used also in machining the steel truck frames for both four and six-wheel trucks for passenger cars, locomotives and locomotive tenders, as well as the one-piece tender underframe. All these large steel castings require considerable machining to assure accuracy in attaching the sills and upper structure of the car body, and absolute squareness of both car body and truck frames—a very important consideration in the construction of passenger cars and locomotives.

The planer illustrated is 88 in. wide between uprights, takes 50 in. between table and crossrail, and planes 18 ft. long, the table being 80 in. wide and 20 ft. long overall. The drive is by a 50 h.p. reversing motor of Niles-Bement-Pond Co., patented system, directly connected to the gearing. The speed of the table is instantly adjustable, without stopping, by hand wheels conveniently located on the controller. The limits are 25 ft. and 50 ft. per minute for the cutting stroke, and between 50 ft. and 90 ft. per minute for the return stroke. The driving motor is directly connected to the first driving shaft at the back of the planer quite out of the way of the operator. The controller, resistance, pilot switch and circuit breaker are mounted in a ventilated cabinet which also contains all wiring except the wires from controller to motor which are carried across the planer bed in metal conduit.

Operating levers on front and back of bed are connected to the reversing switch, and may be operated by hand or automatically by adjustable dogs on the table. At the instant of reversal, the motor, through proper connections in controller, is disconnected from the line and becomes a powerful dynamic brake, stopping the table at once without taking current from the line, while a patented pendant switch carried by a swiveling bracket mounted on the arch, may be moved by the operator to any convenient position, thereby giving him control of the driving motor for starting, stopping or reversing the table, if the work requires him to be in such location that he cannot reach either of the



"POND" HEAVY PLANER, [illegible] IN. X 48 IN. X 18 FT.

levers on the front and back sides of the bed.

To prevent the table running off the gearing, or breakage of tools or planer caused by failure of line current or overload, a patent circuit breaker is provided which will stop the motor at once by dynamic braking. The crossrail is raised and lowered by an independent reversible motor mounted on the arch.

AUTOMATIC DIE COPYING MACHINE.

THE machine here illustrated is one that has recently been developed by the firm of Alfred H. Schutte, Cologne, Germany, for automatically cutting blanking and forming dies by the copying principle. It is adapted for the manufacture of all kinds of stamping dies, such as are used in making automobile and bicycle parts, carriage mountings, etc., as well as for making heading and forging dies for bolt and drop-forging machines. By the use of this machine dies of any shape are copied automatically from a templet.

In order to partly eliminate costly manual labor, fret saws and filing machines are sometimes used, though there are many shops which rely entirely on hand labor. Fret saw and filing machines, however, can only be satisfactorily operated by fairly experienced men, considerable skill being required to turn out first-class work. Furthermore, the expense for new saws and files is considerable, and a die made by such methods can rarely be used without further finishing by hand work.

FIG. 3. THE CUTTING TOOL.

The advantage of the machine here illustrated is that it is fully automatic. After the opening in the die block has been roughed out on a drill press, the block and templet are clamped to the table of the machine, a piece of plate about $\frac{1}{8}$ inch thick being inserted between them. Thereafter the action of the machine is entirely automatic, enabling one operator to attend to several machines, and largely dispensing with highly-paid die-makers. The operation of the machine is similar to that of a draw-stroke keyseater, with the addition of a self-acting copying motion, which results in an exact reproduction of the templet.

FIG. 4. SPECIMEN OF DIES CUT ON THE MACHINE.

The cutting tool, seen in Fig. 3, is triangular in section, and is backed off just below the middle to form a cutting point. The top part of the tool projects a little, serving as a guide, which follows the contour of the templet, no matter

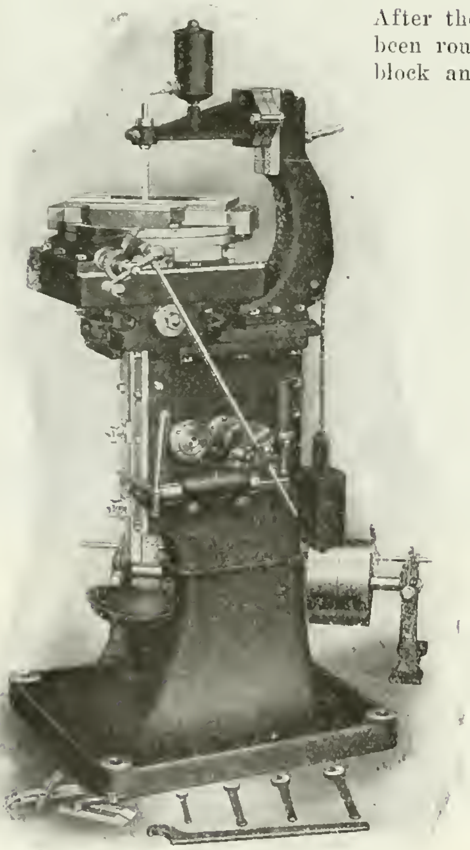


FIG. 1. AUTOMATIC DIE COPYING MACHINE.

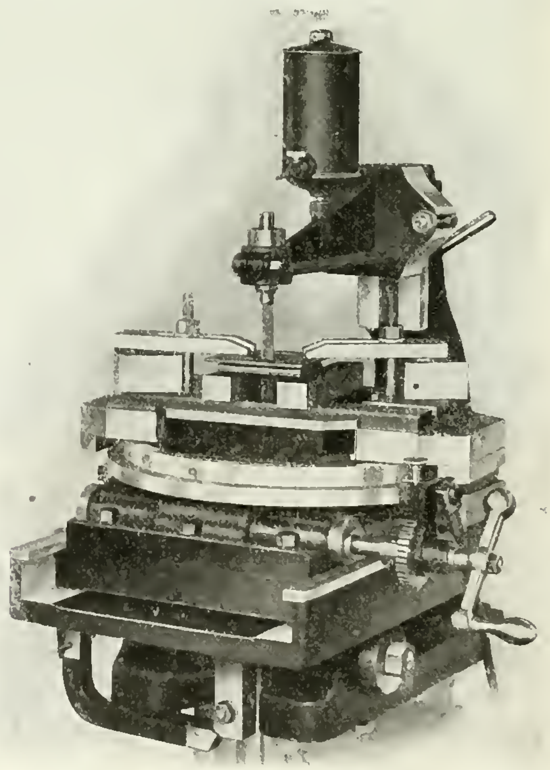


FIG. 2. VIEW OF TABLE, WITH WORK AND TEMPLET CLAMPED IN PLACE.

how irregular the latter may be. Naturally, the more pronounced the off-set is, the deeper the cut.

During the upward stroke of the ram the table, together with the work and templet, is pulled towards the tool by the counterweight seen in Fig. 1, and at the same time is moved through the amount of the feed set. When the ram has reached its highest position the table is automatically locked and the tool cuts. At the end of the stroke the table is

FIG. 5. NUT DIE CUT ON THE MACHINE.

automatically released and the same operation is repeated. Material is removed at full stroke until the inside edge of the templet and the upper edge of the tool are in proximity. When the upper edge of the tool comes in contact with the templet, cutting ceases.

For giving clearance to the die the table can be tilted, a graduated scale being provided for the adjustment. In the case of dies that require no clearance, several can be finished at one setting up to a total thickness of $3\frac{1}{8}$ inches. The standard equipment of the machine allows of copying dies up to $7\frac{1}{2}$ inches cutting length, or up to 15 inches by re-setting. For very long dies an extra

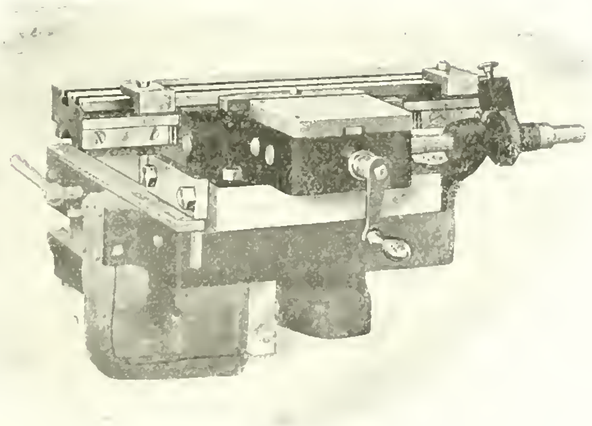


FIG. 6. SPECIAL ATTACHMENT FOR LONG DIES

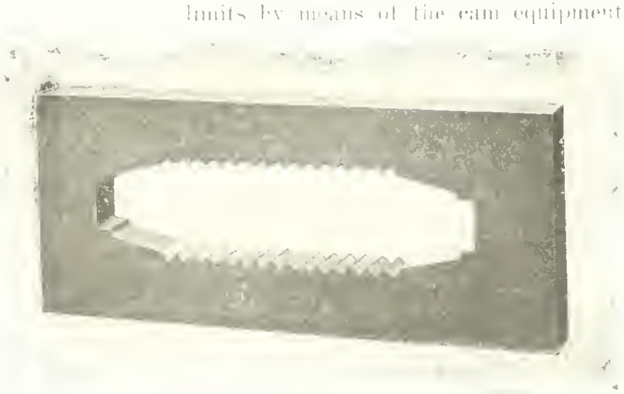


FIG. 7. BICYCLE PEDAL DIE

attachment, shown in Fig. 6, can be furnished, and by means of this dies up to 12 inches cutting length can be formed without re-setting.

Besides the reduction in the cost of output, another advantage claimed for this machine is that all dies made from the same templet are absolutely uniform, a condition very difficult to achieve by hand work. The die is an accurate copy of the templet, has sharp edges, and in most cases can be hardened and used directly it comes from the machine, no further finishing being required.

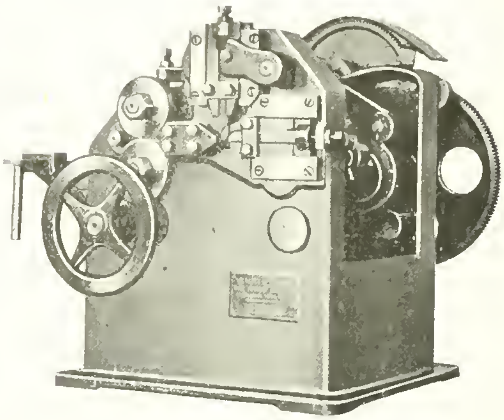
In Fig. 4 are seen three dies, $\frac{5}{8}$-inch thick, just as they came from the machine. The cutting time on these was 45 minutes each. The centre die is of special interest on account of the intricacy of its outline. Fig. 5 shows a nut die, $1\frac{1}{2}$-inch deep, two of which have been finished at one operation in 30 minutes. A die for a bicycle pedal is shown in Fig. 7. This was finished in nine minutes, including the time taken to re-set it three times. No hand work was necessary on any of these dies, and they were hardened immediately after leaving the machine.

The floor space required by the machine is approximately 26 x 26 inches, and the shipping weight is about 1,325 lbs.

The Canadian agents for Alfred Schutte are Messrs. Kauert & Doehler, 35 St. Nicholas Street, Montreal, who report that, after making an experimental purchase of one machine, the German General Electric Company have recently placed a further order for fourteen.

SPECIAL SPRING COILING MACHINE.

THE machine illustrated is a new type of spring coiler which has been developed recently by Sleeper & Hartley, of Worcester, Mass., and Coaticook, P.Q. It is especially intended for the spring maker on the one hand, and for industrial establishments on the other. The design represents a novel combination of elements which have been found by experience to possess marked advantages in the production of spring forms. It is capable of producing either extension or compression springs, and the length of spring which may be produced can be varied within very wide limits. These machines may be adapted either for continuous coiling, or they may be equipped with cutting devices for intermittent coiling and cutting to pre-determined lengths. In addition, they may be equipped with pitch tools of an adjustable type, and also with a diameter-varying attachment, by means of which either extension or com-



SPECIAL SPRING COILING MACHINE.

pression springs may be produced in coned or barrel forms of various kinds.

The machines comprise in their most complex forms all the necessary means for making a wide range of springs, either extension or compression, and are built in the following sizes:—

No. 00, handling wire up to .015 in. diameter.

No. 0, handling wire from No. 32 to No. 20.

No. 1, handling wire from No. 24 to No. 14.

No. 2, handling wire from No. 16 to No. 6.

No. 3, handling wire from No. 6 to $\frac{3}{8}$ inch.

The feed may be varied within wide limits by means of the cam equipment, and may also be varied by means of a train of gears interposed between the driving mechanism and the cam shaft.

This product marks an addition to the list of extremely novel spring making machines which have been developed by Sleeper & Hartley during the last few years.

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Vol. XI. APRIL 30, 1914 No. 18

PRINCIPAL CONTENTS.

PRACTICAL ENCOURAGEMENT OF ECONOMY.

THE secrecy maintained by many and especially large manufacturing concerns regarding costs of material and operation may have its useful ends, but it also has drawbacks. A little judicious confidence with the men interested in these matters cannot but do considerable good.

The store-keeper should know the value of the materials which he has to hand out, for with him economy should begin. If the machine man knew the cost of high speed steel, oil cans, etc.; if the oiler knew the value of waste and the comparative costs of lubricants, and if the sweepers and truckmen were given a knowledge of the scrap value of remnant and worn out materials, the interest aroused would result in a large saving for the company of what otherwise goes to waste.

True it is that some few might make improper use of such information, but, as the average workman is brought up to practise economy in his home, his saving propensities will, no doubt, predominate over any tendency to extravagance or dishonesty.

PROTECT THOSE SET-SCREWS.

ONCE more the projecting set-screw has been the cause of a fatal accident. On April 21, a painter was at work on the ceiling of a laundry in Charlottetown, P.E.I., when the sleeve of his coat got caught by a set-screw projecting from a line shaft. He was whirled round the shaft several times before the machinery could be stopped, his body being forced each time through a space of 18 inches between the shaft and the ceiling. Both legs were badly broken and he received other serious injuries, which resulted in his death six hours after the accident. Is it not about time that the use of projecting set screws should be absolutely prohibited by law unless they are fully guarded by safety collars?

EDUCATING THE MECHANIC.

A RECENT speech of Dr. F. W. Merchant, M.A., before the college and high school department of the Ontario Educational Association, contained a brief and comprehensive description of the status of vocational training in Ontario, as well as some valuable, though modest, remedial suggestions.

The necessity of trade schools is the result of the rapidly changing systems of manufacture. The old methods provided facilities for many apprentices, but to-day, the tendency of specialization, in even the smallest elements of the metal trades in particular, renders it almost impossible for a boy to become a well-rounded craftsman. Very few of our manufacturing institutions have any apprentice system whatever. One Ontario plant employing over 2,000 men has not had an apprentice in twelve years.

Even if the shops did furnish the requisite number of young men with practical training, it is certain that our public schools do not supply the groundwork by a suitable mathematical and executive education. The fact that many of our most successful men left school before the age of fourteen, shows that a large part of the education received beyond this is more or less superfluous.

The scope of the technical schools in Ontario is such that they would provide training for less than two per cent. of the school boys of the province. What there is deals very largely with wood working, while the fundamental and nationally important trades, those contiguous to the iron and steel industries, are sadly neglected.

The first step is obviously to provide a sufficient elementary mathematical education to enable the student to enter a trade upon graduating from the high school with only the practical side of the business to master. If the young mechanic wish it, a thorough technical school training in his chosen vocation should now be open to him. If, however, lack of time or funds prevent this, the technical training available at night schools should be such that, when coupled with his shop work, he would have the opportunity of making of himself a first-class, reliant and aggressive tradesman.

INDUSTRIAL NOTABILITIES--No. 32

MAXIMILIAN EUGENE DUNCAN was born March 28th, 1862, in New York City, a son of Maurice and Caesarine (De Villars) Duncan. The father was a native American, of Scotch and German descent, while the mother was born in France, a descendant of the historical De Villars family.

He received his education, or rather his schooling in New York City, as he became a messenger boy at the early age of thirteen. He was next employed in the manufacturing department of the Pullman Co., and from there he went to a Car Company at Jeffersonville, Ind. This company was subsequently absorbed by, and now forms one of the constituents of the American Car & Foundry Co.

MAXIMILIAN EUGENE DUNCAN

When this consolidation took place Mr. Duncan went with the new corporation in 1899, and remained with them until 1912, occupying the office of General Sales Agent.

He is vice-president, general manager and director of the Canadian Car & Foundry Co., of Montreal; a member of the St. Louis and of the Noon day Clubs of St. Louis, Mo.; a member of St. James and Mount Royal Club, Montreal, and Beaconsfield Country Club.

Mr. Duncan married Lillian Louise Gorby, of Alabama, daughter of the celebrated geologist, Sylvester S. Gorby, the union bringing two children. Mary Dean Duncan, born in 1892, and Maurice Eugene Duncan, born in 1897.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 65
Lake Superior, charcoal, Chicago	.....	16 00
Ferro Nickel pig iron (Soo)	.....	25 00
	Montreal.	Toronto.
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	19 00	18 35
Victoria, No. 2X.......	18 75	18 10
Victoria No. 2 Plain...	18 50	17 85

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.05
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAILS AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, 5/8 diam., 100 lbs.		2 85

BOILER PLATES.

	Montreal.	Toronto.
Plates, 1/2 in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1 1/4 in.	9 50	9 00
" " 1 1/2 "	9 50	9 00
" " 1 3/4 "	9 50	9 00
" " 2 "	8 75	8 75
" " 2 1/2 "	11 15	11 50
" " 3 "	12 10	12 50
" " 3 1/2 "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7 1/2
Coach and lag screws....	75
Plate washers	45
Machine bolts, 3/8 and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4 1/4 per lb. off
Nuts, Hexagon, all sizes..	4 1/2 per lb. off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright	85, 10, 7 1/2, 10, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7 1/2, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7 1/2, 10 p.c. off

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong, Sizes Ins.	Extra Strong, Price per ft.	D. Ex. Strong, Size Ins.	D. Ex. Strong, Price per ft.
1/8 in	$ .05 1/2	1/8 in	$ .12	1/2	$ .32
1/4 in	.06	1/4 in	.07 1/2	3/4	.35
3/8 in	.06	3/8 in	.07 1/2	1	.37
1/2 in	.08 1/2	1/2 in	.11	1 1/4	.52 1/2
3/4 in	.11 1/2	3/4 in	.15	1 1/2	.65
1 in	.17 1/2	1 in	.22	2	.91
1 1/4 in	.23 1/2	1 1/2 in	.30	2 1/2	1.37
1 1/2 in	.27 1/2	1 1/2 in	.36 1/2	3	1.86
2 in	.37	2 in	.50 1/2	3 1/2	2.30
2 1/2 in	.58 1/2	2 1/2 in	.77	4	2.76
3 in	.76 1/2	3 in	1.03	4 1/2	3.26
3 1/2 in	.92	3 1/2 in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4 1/2 in	1.27	4 1/2 in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
1/4, 3/8 in.	64	49	....	....
1/2 in.	69	58	....	....
3/4 to 2 in. ...	73 1/2	63 1/2	....	....
2 in.	....	....	69 1/2	59 1/2
2 1/2 to 4 in. ...	73	63	72	62
4 1/2 to 6 in. ..	....	....	73	63
7, 8, 10 in.	....	....	67 1/2	56 1/2
X Strong P. E.				
1/4, 3/8 in.	56 1/2	46 1/2	....	....
1/2 in.	64	54	....	....
3/4 to 1 1/2 in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2 1/2 to 4 in. ...	....	....	66	56
4 1/2 to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
1/2 to 2 in.	43	33	....	....
2 1/2 to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 75	$15 75
Electrolytic copper	15 50	15 25
Casting copper	15 00	15 00
Spelter	5 25	5 25
Tin	37 00	41 65
Lead	4 85	5 30
Antimony	8 50	8 50
Aluminum	20 00	19 00

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, $10^3/_4$ oz. (American)	4.50	4.40
Queen's Head, 28 B.W.G.	4.40	4.65
Fleur-de-Lis, 28 B.W.G.	4.20	4.45
Gorbal's Best, No. 28	4.40	4.65
Viking metal, No. 28	4.20	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal	0.22
Pure turpentine	0.69
Linseed oil, raw	0.61
Linseed oil, boiled	0.64
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., April 27, 1914.—It is somewhat disappointing to have to report that the improvement noticeable last week has hardly been maintained. Perhaps the improved conditions were more apparent than real and the pronounced optimism the result of the placing of two substantial orders that week. This time last year brokers were doing a flourishing business in "pick-up" orders for single machines, often booking three and four such orders a day. Now, they are thankful for one or two a week.

Norton, Griffiths & Co., Ltd., St. John, N.B., are erecting a new machine shop at Courtenay Bay, in connection with their government contract. This shop will take care of repairs to equipment and will be fitted out with modern machine tools, mostly of a heavy character. Tenders for these are now being submitted by all the leading houses, and some keen competition may be looked for.

There is a fair trade being done in boiler and tank plates, and an improvement is looked for from now on, owing to navigation being again open. Speculation is rife as to what decision has been reached by the Government with regard to the Canadian Northern bond guarantee. An announcement is expected this week. Rumor says that the plan provides for the consolidation of C. N. R. subsidiary companies with the parent system and practically government control of a majority of the common stock. This would be the security the C. N. R. would have to give for the bond guarantee it is seeking. This bond guarantee, it is said, will amount to about half of the sum needed to complete the road and the company will have to finance the remainder itself. If this scheme goes through, it will probably mean a great deal to Montreal, as it is anticipated that the C. N. R. will place a large order for locomotives and cars, which local firms will make strenuous efforts to obtain.

The Canadian Vickers Co. state that the keel of the ice breaker which they are to build for the government will be laid at their Maisonneuve yards some time next month, and it is fully expected that this will inaugurate a long and prosperous career for this ship-building plant.

Navigation on the St. Lawrence is now open. All buoys have been placed and the first ocean boat is due at Quebec to-morrow, and at Montreal on Wednesday, the 29th inst. The local ferries to Longueuil and Boucherville have been running for several days.

The metal market is still quiet, though copper and lead both show a firmer tendency. The Mexican situation has not yet had any influence locally on the price of lead, but dealers are watching the situation closely.

Toronto, Ont., April 28, 1914.—Industrial conditions appear to be marking time, no improvement being noticeable this week. The advent of more seasonable climatic conditions should stimulate business generally, especially the building trade; signs are wanting, however, of much activity in this connection at present. The Mexican trouble has assumed a more unfavorable aspect, and will indirectly affect this country, through the money market. Those holding Mexican securities will be glad when order is restored again. The opening of navigation on the Great Lakes has already had the effect of producing a scene of greater activity on the water front. The Toronto Street Railway Co. has inaugurated a "Safety First" campaign similar to one which has already been promoted by the Montreal Tramways Co. This is further evidence of a desire on the part of public companies to safeguard both the public and their employees.

It is hoped that a start will soon be made on the much-talked-of new Union Station. The plans have been presented by the railway companies interested to the Dominion Railway Board for approval, and the representatives of the city will now pass upon them. It is expected that a decision will be arrived at early in May, and the work commenced as soon as possible thereafter. The plans call for a fine structure, and incidentally a much needed one. There have been several local companies incorporated recently, the most important being the Dominion Engineering and Machinery Co., Ltd., which has taken over the Ontario Wind Engine and Pump Co., and proposes to make considerable extensions to the plant.

The steel market is quiet, and everything points to a continuance of this condition. We understand that the mills have, in some cases, been making an effort to raise their prices on certain lines, but we do not believe that any business was done at the increased rate. It is extremely doubtful that better prices will be obtained under the conditions now prevailing. Reports from the United States indicate that the steel works are operating at a further reduced tonnage, the output being less than earlier in the month. It has been reported that the United States Steel Corporation will begin, shortly, the construction of a wire rod mill at Ojibway, Ont., and it is rather doubtful if anything further will be done in this direction this year. We understand that the structural mill which the above company propose establishing there depends to a large extent upon the Dominion Government agreeing to increase the duty on rolled shapes to double the present rate. If the guarantee is forthcoming, the financing of this project will be easy to accomplish.

The pig iron market shows no improvement, and is still very quiet. Prices remain the same, although there are indications that a slight reduction may be made unless conditions improve materially.

Dealers in machine tools report business as being quiet, with few inquiries in view. One firm report having had a good week, the orders booked embracing several grinders, hack saw machines and drills for the Trussed Steel Concrete Co., Walkerville, Ont., and a 24-in. "Stockbridge" shaper for the Canadian Metal Products Co., Galt, Ont.

The metal market is quiet, little change having taken place during the week. Prices rule the same, with the exception of tin, which is being quoted in London, England, at an advance of £3 per ton, which is equivalent to 5/8 cents per pound. Dealers report a scarcity of lead.

CANADA'S TRADE WITH BRITAIN.

THE following are the official figures of trade between Great Britain and Canada during March:

From Canada:	1914.	1913.
Wheat	£516,697	£395,001
Wheat meal and flour	189,105	170,899
Barley	20,082	48,925
Oats	2,798	13,091
Bacon	63,670	92,320
Hams	25,052	28,289
Cheese	850	87,588
Canned Salmon	236,249	21,294
To Canada:	**1914.**	**1913.**
Spirits	£53,662	£40,125
Wool	6,355	13,568
Pig iron	4,037	6,459
Wrought bars	3,372	7,189
New rails	110	60
Galvanized sheets	20,819	30,262
Tinned plates	4,887	8,208
Steel bars, etc.	6,282	31,888
Pig lead	4,168	8,138

CANADIAN TRADE RECORD.

THE total trade of Canada during the year just closed reached the splendid total of $1,112,562,107, an increase of $44,000,000 over the total of the previous year.

Domestic exports during the year amounted to $431,589,658, as against $355,754,604 for the previous fiscal year; a gain of $75,835,058.

Imports declined during the year by $41,868,989, the total for the year being $633,564,179, as against $675,428,168 for 1913. During the last month of the fiscal year the imports amounted to $67,904,336, an increase of $13,384,107. Exports showed a decrease, the total for the month being $26,701,026, compared with $34,874,752 for the corresponding month of the previous fiscal year.

The total trade for March was $92,887,053, a decrease of $13,261,199. An increase of $8,500,000 is shown in the exports of domestic animals and their produce, the total under this head being for the year $53,349,119.

Exports of domestic manufactures also increased, the gain in this case being $13,750,000 on a total of $57,443,452. Exports under the head of agriculture increased $48,000,000, the totals being for 1913, $150,545,661, and for 1914, $198,220,029.

WESTERN CANADA POWER CO.

THE revenue of the Western Canada Power Co. for the year ended December 31 last fell considerably below estimates, the reasons for this given in the annual report, which was mailed to shareholders on April 27, being, first, unavoidable delays in getting the B. C. Electric Railway contract into working order; and, secondly, the general depression in industrial business, which caused a large proportion of the motors connected to the company's mines to be idle.

"The financial depression of 1913," says Mr. C. H. Cahn, the president, "undoubtedly set back the company's earnings from twelve to eighteen months, and the first three months of 1914 have shown poor returns on account of the shutting down of mills in January for the overhauling which occurs every year, but which was more general this year than usual. Already, however, the mills are beginning to start again, and there are indications from all sides that business will soon regain normal conditions. With so many large motors already connected to the company's mains, revenues for industrial power will increase very rapidly when the mills commence to run again.

"The company is still treated as being in the construction stage, a balance sheet is presented, but no profit and loss account is shown. As to this, the auditors remark that as the undertaking of the company is not yet completed and in full operation, by resolution of the board of directors, interest on bonds to date has been charged to construction account, and the revenues received from the sales of electric energy, in excess of operating expenses have been credited to the same account."

The operating profit is not given, but in the course of the annual report it is stated that in the twelve months ending December 31, 48,196,000 kilowatt hours were sold and realized a revenue of $293,697. Against this it was estimated a year ago that net earnings available for bond interest would be $375,000.

Contracts for two 9,000 kilowatt units in addition to the two put in commission on January 1st, 1912, were placed last year. One of the new units will be installed this summer and the other in 1915. The ultimate capacity when the four units have been installed will be 52,000 horse-power. Future developments aim at an ultimate capacity of 140,000 horse-power.

Dealing with the B. C. Electric Railway contract, it is stated that the company is now taking between 6,000 and 8,000 horse-power, and will probably take from 10,000 to 12,000 horse-power after September 1, 1914. Western Canada Power has also made a contract with the Puget Sound Traction, Light and Power Co. for the supply of 66,000 horse-power, and the company is now taking the full amount.

AFFAIRS AT PORT NELSON.

M. J. JENKINS and James H. Burke, young Canadians, arrived in Winnipeg over the frozen trails from Port Nelson, and they have been quoted as confirming previous reports of disaster and misfortune to Government boats and stores.

A total of 126 men spent the winter at Port Nelson in the employ of the Government, they say. The steamer Ceranze is still stranded on the rocks ten miles out from the coast, and the steamer Allette is beached five miles up the Nelson River. The men say no watch was kept on the Alletta, which has been looted of fixings and equipment. They estimate the cost to the Government through the loss of boats at $500,000.

Jenkins and Burke state further that the new dredge Port Nelson, built in Toronto, is in bad shape. It was beached in the river, but carried on to the rocks by wind and tide. It cannot be used until repaired in dry dock, and there is no dry dock in the north.

They find fault with the sanitary conditions at Port Nelson, and assert the housing conditions were so bad that mounted police ordered the bunk-houses cleaned out.

They tell how Arthur Sinclair, a half-breed Indian, traveled 65 miles through the snow in the most extreme weather to Port Nelson in order to bring help to two companions who were forced through frozen feet to camp on the trail and wait for succor.

MANGANESE STEEL RAILWAY MATERIAL.

IN a recent paper by Sir Robert Hadfield, presented at a New York meeting of the American Institute of Mining Engineers, the author traced the history of manganese steel railway material during the last twenty years. He said that, although at the beginning of that period there was no difficulty in

making and producing manganese steel in various forms, rolled or pressed, on account of its higher expense, sufficient encouragement was not then obtained from the users to introduce these products on a large scale. The matter was further pursued in the present decade.

In 1904, a French manufacturer produced light manganese steel rails, tests of which were so satisfactory that heavy sections of 100 lb. per yard were then made in the same rolling mill. A large number of these rails were rolled in 1907, and were supplied to the Metropolitan Electric Railway of Paris, and put to work among other places at the Bastile Station in that city. These rails, during several years of service on severe curve work, had given great satisfaction. After three years' hard service, the actual wear was found to be not more than about 2½ mm. It had been estimated that the rails would remain in service for six to seven years before being worn out, whereas ordinary steel rails wore out and had to be replaced in less than a year.

Under the system devised by the writer no less than 90 per cent. of sound ingots was obtained from an alloy steel. Each 1 per cent. of expensive material saved meant that much reduction in the cost of production. The consumer had now to pay for 15, 20 or even 30 per cent. of waste in special steels made in the ordinary way, whereas this waste could to a large extent be avoided.

OBSERVATIONS ON BUSINESS FATIGUE.

In the course of an address made before the Western Efficiency Society, on February 27, in discussing the problem of human efficiency with special reference to the industries, Herbert L. Trube, Indestructo Company, Mishawaka, Ind., made the following observations on the subject of fatigue:—

Those conditions which hinder attention have the direct effect of decreasing the product of labor. Both the feelings of monotony and fatigue are two such conditions, and, therefore, for high efficiency should be avoided. Primarily, fatigue is due to continued application to an activity without adequate relaxation. Secondarily, it results from the conscious or unconscious effort expended in overcoming distractions. I believe the greater part of the fatigue which is developed in our factories and offices is due to the fact that in striving to give full attention to the work in hand the individual wastes his much needed energy in resisting interferences.

The modern business man is exhausted no more by his actual achievements than by the things which he is compelled to resist doing. Appeals for his attention are ceaseless. The roar of the street, the ring of the telephone, the din of typewriters, the sight of a row of men waiting for an interview, the audible conferences of neighboring office men, the plan for the day's work which is delayed, the anxiety for the results of certain endeavors, suspicion as to the loyalty of employees—these and a score of other distractions are constantly bombarding him.

In a similar way, the workman in the shop resists the distractions of unnecessary noises, unnecessary conversations, unnecessary sights, etc. Walter Dill Scott, professor of psychology, North-Western University, says in substance, "As any source of light gives off equally in all directions, so the human intellect seems designed to absorb from all directions." To prevent waste of energy, therefore, all possible distractions should be removed, thus leaving the mind free to concentrate on the work in hand.

MESSAGE TO G.T.R. MEN.

Every employee of the Grand Trunk and Grand Trunk Pacific Railways last week received a circular from President E. J. Chamberlin, in which he demands the best possible service from railwaymen to their patrons.

"The ticket rates are alike for all," says the circular, "and any person buying a ticket, no matter what style his clothes, how much money he displays, or what his position in society, is entitled to proper and courteous treatment.

"The railroad man has a great opportunity for passing out kindness and goodwill. He comes in contact with every kind and condition of individual: the old, the young; the rich, the poor; the illiterate, the learned, the happy, the prosperous, and those in defeat. He knows to which class they belong. A smile, a kind word, or a kindness done to any of these cannot fail to leave its impression for good and this good cannot help but expand. Try it."

There is also a word as to freight shippers, saying that their needs and wishes should be anticipated as much as possible.

Dennis McGuire, a locomotive engineer on the Lehigh Valley Railroad, has been granted a month's leave with pay and an honor button for having brought forward a new "safety-first" idea. He suggested to Superintendent Charles Shea that engine inspectors be equipped with magnifying glasses, so that they might more readily detect cracks and flaws on axles and other mechanism. The suggestion was at once adopted, and McGuire received his reward.

BY-PRODUCT AND BEEHIVE COKE. OVEN YIELDS.

Canada and the United States are far behind Germany and other foreign countries in realizing the economies resulting from the coking of coal in by-product ovens. In Germany, at the present time, little or no coke is made in retort (by-product) ovens.

When the economies which may be effected by the use of such ovens have been so clearly demonstrated, not only by plants which have been constructed in Europe, but also by plants at Sydney and Sault Ste. Marie in Canada, and in the United States, it is difficult to understand why they are not more generally adopted in Western Canada. No doubt the greater cost of installing them, and the lack of markets for the resultant by-products, have hindered progress in this direction in the past. The development of the West, however, is rapidly creating local markets for the products, and, in view of the higher yield, the greater initial cost should no longer be a deterrent.

Economies Effected.

The following are some of the economies which may be effected by the use of by-product coke ovens as against the use of beehive ovens:—

1.—The quality of the coke is just as good for metallurgical purposes as coke made in beehive ovens.

2.—The yield of coke from by-product ovens is from 10 to 15 per cent. higher than the yield from beehive ovens.

3.—While the cost of installation per oven is greater for the by-product than for the beehive oven, the capacity is from three to six times as great.

4.—In by-product ovens, the following by-products are saved:—

Gas.—Coke oven gas is an ideal fuel, and may be used for burning under boilers, driving gas engines, for domestic purposes and illumination.

Ammonia.—The ammonia may be recovered as ammonium sulphate or ammoniacal liquor. In the former case it is used as a fertilizer, while in the latter, it can be used for making many chemical products and also as the freezing agent for refrigeration purposes.

Tar.—The tar may be used in the manufacture of various kinds of roofing, for covering pipes, etc. It can be distilled, yielding pitch, creosote, light oils, carbolic acid, etc. Creosote is especially useful as a wood preservative. Pitch is used for road-making and as a binder for the manufacture of coal briquettes.

Fuller information on this important subject can be obtained by persons interested from a report entitled "Conservation of Coal in Canada," by W. J. Dick, M.Sc., recently published by the Commission of Conservation.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Redcliff, Alta.—The Redcliff Rolling Mills & Bolt Co., have recently installed new machinery.

Tillsonburg, Ont.—The municipal council has decided to purchase a new electric pump for the power house.

Welland, Ont.—It is announced that the Welland Machine & Foundries, Ltd., will erect a new foundry. The plans are completed and construction will begin shortly.

Sault Ste. Marie, Ont.—The Dominion Government have signed an agreement with the Lake Superior Dry Dock and Construction Co. for the construction of a dry dock here.

Prince Albert, Sask.—Plans for alterations to the sewage pumping station at a cost of $4,500, have been drawn. Pumps, valves, hydrants, meters, etc., will be required.

Sydney, C.B.—Renewed activity is indicated at the plant of the Dominion Iron and Steel Co., by the announcement that in a short space of time the company will blow-in another blast furnace.

Maisonneuve, Que.—The United Shoe Machinery Co. will erect a new factory at a cost of $300,000. The building will be two storeys high, 164 ft. by 140 ft, of brick construction. The general contractors are C. E. Deakin, Ltd.

Bridgeburg, Ont.—The plans for the new factory building of the International Register Co., of which D. H. and S. A. Waugh are the chief promoters, have just been completed, and contracts for construction will be let shortly.

Port Arthur, Ont.—John E. Conley, of Memphis, Tenn., president of the Conley Frog & Switch Works, is making preparations for the building of a frog and switch plant in the city. A bonus of $25,000 has been voted by the ratepayers for the factory.

Medicine Hat, Alta. — Gilbert Hunt and associates of Walla Walla, Wash., recently signed a contract with the town of Dauntless to build a big plant for the manufacture of threshing machines, feed grinders and other farm implements. This industry, which will be known as the Dominion Harvester Co., is the first of its kind in Western Canada. The plant will ultimately employ about 500 men and will represent an investment of $750,000. Construction is to start within two or three weeks.

Windsor, Ont.—The Canadian Zagelmeyer Co., has purchased a site of three acres in the factory district on Howard avenue. The plant will be devoted to the manufacture of moulds and machinery for Canadian and export trade. It will be a branch factory of the Zagelmeyer Machinery Co., in Bay City, Mich.

Niagara Falls, Ont. — The Dominion Chain Co. by-law to raise by debenture $12,000 to purchase a site for the company was carried here on April 23, seven to one, the vote being 932 for and 128 against. The company will erect a $95,000 plant, placing $90,000 worth of machinery therein, and will agree to employ 150 workmen.

New Westminster, B.C.—The Heaps Engineering Co., of this city, are calling tenders for the completion of the machine shop and foundry buildings, located on Lulu Island. These tenders are to be in by the end of this month, when the contract will be immediately awarded and work started. H. Schaake is general manager.

Electrical

Tavistock, Ont.—It is reported that a hydro-electric by-law will probably be submitted to the ratepayers.

Galt, Ont.—The last applicant for hydro service in this district is Wellesley Village, from which a fully signed petition has been sent to the commission.

Lake Megantic, Que.—Plans for the installation of a hydro-electric plant, at a cost of $150,000, have been accepted by the town council. Engineer E. A. Evans, Quebec.

Stouffville, Ont.—The proposed reconstruction of the wires, poles and outside equipment of the municipal electric light plant will be considered by the village council at their meeting next Monday.

Hamilton, Ont.—The Monarch Refillable Fuse Co. has been organized for the purpose of manufacturing electrical fuses. The fuses to be manufactured are the invention of Frank Kaiser, of Buffalo. As soon as a site has been chosen, a factory will be built.

Chatham, Ont.—Engineer Jeffrey, of the Hydro-Electric Commission has proposed to the city council that the city erect a power plant, at a cost of $89,000, and enter into competition with the Chatham Gas Co., which last month refused an offer of $410,000 for their gas and electric light plants. No action was taken.

Wallaceburg, Ont.—An offer was received by Mayor Dundas on April 23, from the Wallaceburg Gas Company, to sell the electrical end of its plant for $30,000, on condition that Hydro-Electric power is connected with its lines by Dec. 31 of this year. The offer will be submitted to the people, together with a by-law for $36,000 for equipment for the Hydro-Electric station.

Municipal

Longueuil, Que.—The council have decided to raise $90,000 to be spent on sidewalks, roads, etc. A. Ste. Marie is town engineer.

Alexandria, Ont. — A representative of the American Financial & Promoting Co., interviewed the Board of Trade recently to lay before them a number of proposals regarding the establishment of new industries here.

Berlin, Ont.—The Ontario Municipal and Railway Board have ratified a by-law to raise $67,000, recently submitted by the Berlin Light Commission. This will enable the commissioners to let the contract for the new gas-holder.

Guelph, Ont.—At the annual meeting of the Board of Trade held on April 22, the following officers were elected:—President, Alex. Simmers; vice-president, W. E. Buckingham. The secretary-treasurership was left in the hands of the new council of the board.

Berlin, Ont.—The city council on April 20, decided to purchase a 50-horse-power motor fire truck, valued at $3,400, equipped with one 40-gallon chemical tank from the Gramm Motor Co., of Walkerville. It is expected the new fire hall in the north ward will be completely equipped in six weeks.

Morris, Man. — The Acetylene Construction Co., of Brandon, have con-

cluded a deal with the Morris town council for the purchase of the town gas plant. The purchase price was $3,500, and included the town contracts for street lights for ten years. The by-law ratifying the agreement will be submitted to the ratepayers for approval by vote.

Belleville, Ont. — The officers of the Board of Trade of this city elected for the ensuing year are: President, H. F. Ketcheson; vice-presidents, F. S. Deacon, J. W. Johnson, M.P.P.; treasurer, John Elliott; secretary, Col. W. N. Ponton, K.C.; chairman of transportation, ex-Mayor H. W. Ackerman; executive council: C. M. Reid, W. C Springer, T. Blackburn, J. O. Henty, C. J. Bowell, W. B. Riggs, Col. L. W. Marsh, A. J. McLaren, O. Scott, W. B. Deacon, Mark Sprague; auditors, H. Sneyd, A. M. Chapman.

General Industrial

Brampton, Ont. — The Lindus Co., Ltd., will erect a plant to cost about $50,000.

Toronto, Ont.—The Gerhard Heintzman Piano Co., is contemplating the erection of a factory at Vancouver, B.C.

Sudbury, Ont.—The Provincial Government have made a grant of $50,000 to be expended on road improvements in this district.

St. Boniface, Man.—The town council are negotiating with a company who propose building a plant to make automobile tires.

Waterford, Ont.—The United Universal Chemical & Electrical Co., will erect a factory for the manufacture of electrical fixtures, telephones, etc.

Port Colborne, Ont. — The by-law granting a fixed assessment of $10,000 for a term of ten years to the Niagara Grain & Feed Co., was carried by a large majority.

Corunna, Ont.—The Canadian Oil Co. will start this week to put down a concrete underground tank, 60 x 60 feet, with a capacity of 10,000 barrels of crude oil.

Goderich, Ont.—The salt plant located here and owned by John Ransford, of Clinton, will have its capacity increased from an output of 120 to 800 barrels daily, at a cost of $40,000 for machinery.

Calgary, Alta.—The British Columbia Refining Co., have purchased a site here and will install four storage tanks, each having a capacity of 12,000 gallons. It is probable that a refinery will be built here if oil be found in sufficiently large quantities.

Winnipeg, Man.—The Cocoa-Cola Co. will establish a branch here. S. C. Dobbs, vice-president of the company, states that a site has been purchased and a factory will be erected at a cost of $250,000.

Peterborough, Ont.—A manufacturer of children's shoes who is now operating on a small scale in another Ontario city, will, it is understood, locate here, if he should be successful in securing sufficient stockholders' capital.

Weyburn, Sask.—The Winnipeg Oil Co., have recently made extensive additions to their oil plant at this point. Two large new steel tanks of 20,000 gallons capacity have been installed with the most modern facilities for barreling. Mr. E. N. Howard is manager.

Galt, Ont.—The Maple Leaf Bedding Co. has been organized with the following officers:—President, J. C. Dietrich, Galt; vice-president, C. C. Osborne, Toronto; treasurer and managing director, Roy Torrance; Galt; secretary, G. Gordon Plaxton, Toronto; J. W. Daw, Hamilton, director. The concern will take over the bed manufacturing business formerly conducted by the Shurly, Dietrich Co., Ltd., whose plant was re-

cently destroyed by fire. Twelve thousand is asked from the town of Galt. A by-law authorizing the loan will be submitted.

Estevan, Sask.—William Kinney, of Kenora, president of the Great West Brick and Coal Co., has made arrangements whereby the municipal power plant will supply him with the remaining available capacity of current. Development work entailing an expenditure of approximately $100,000 will be commenced in May. The plant will be the largest of its kind in Saskatchewan.

Wood Working

Welland, Ont.—The Welland Lumber Co., Ltd., will erect a sash and door factory here.

Campbellford, Ont.—The Northumberland Paper & Electric Co., will improve and enlarge its box-board mill.

Eburne, B.C.—It is reported that the Merritt Lumber Co. will erect a lumber and shingle mill at an estimated cost of $50,000.

New Westminster, B.C.—The Westminster Woodworking Co. have leased the site of the old Ciff Canning Co., and will build a factory.

Blairmore, Alta.—The McLaren Lumber Co., contemplates the erection of a sawmill, at a cost of $200,000. Machinery, boilers, etc., will be required.

New Westminster, B.C.—The British-Canadian Lumber Corporation, who were obliged to close down their plant on Lulu Island, have decided to start operations again.

New Westminster, B.C.—The Shull Co. will erect a large shingle mill here. Twenty-five machines will be installed at first; the total capacity being half a million shingles per day.

New Westminster, B.C.—It is announced that the M. B. King Lumber Co. have secured control of timber limits owned by D. K. Campbell, and that a large sawmill will be erected, with a capacity of 100,000 feet per day.

Kemptville, Ont.—The sash and door factory and planing mill formerly owned by the Palmer Lumber Co., which has been closed since last October, has started operations under R. D. McMaster.

Redcliff, Alta.—R. S. Houston and A. B. Henley have started erecting their new planing mill. The building will be 50 x 80 feet and one-storey high for the present, allowance being made for the addition of two more storeys later. The company will manufacture mouldings, sashes and doors.

Eburne, B.C.—It is announced that negotiations are proceeding between the council and three companies who are proposing to locate here. The industries comprise a lumber mill, shingle mill, and box factory respectively.

Trade Gossip

The Boving Co., of Canada, Ltd., Toronto, has been granted a license to carry on business in the Province of British Columbia.

The North Bay Steamship Co. has been organized, with headquarters at Port Hood, N.S. The steamer Kinburn has been purchased, and will be refitted.

A. Belanger, Ltd., Montmagny, Que., have taken over the foundry and stove works, formerly the property of Mr. A. Belanger, who has been appointed to the office of honorary president.

William Hamilton Co., Ltd., Peterborough, Ont., have been awarded a contract by the town of Outremont, Que., for 125 combination lighting and trolley poles and for 375 ornamental lighting standards.

Masson, Ltd., Quebec, have taken over the structural steel and foundry business formerly carried on by A. D. Masson. The directors are Messrs. D. Masson, A. D. Masson, J. Masson and E. D. Kellog, M.E.

The Burrard Engineering Co., which was awarded the contract for the laying of the riveted pipe for the flow line from Humpback reservoir to the city. A capital of one hundred thousand dollars is authorized and the company is empowered to carry on general business as engineers, contractors, builders, pipemakers, etc.

Nova Scotia Pig Iron.—Rogers, Brown & Co. are continuing to import high-phosphorus Nova Scotia pig iron. The first cargo was shipped from Sydney, N.S., by the Dominion Iron & Steel Co. the first week in April, and discharged at Philadelphia. Two more steamers carrying cargoes of pig iron sailed from Sydney last week—one for Bridgeport, Conn., and one for Philadelphia and this iron will be imported by the firm in large quantities hereafter.

The Eastern Steel Co., Ltd., Halifax, N.S., has been incorporated by James A. Stairs, Halifax, and others, with a capital stock of $1,000,000. It has purchased the plants and good will of the Brown Machine Co., and the Bailey-Underwood Co., both of Trenton, N.S., and will continue the manufacture of coal-handling machinery, agricultural implements and kindred lines made by these companies. It is stated that plans are in progress for additions to the plants and equipment.

German Business Men Coming.—Hon. Geo. E. Foster, Minister of Trade and Commerce, has received communications from Leipzig informing him that it is proposed to organize a German business men's trip to Canada in the year 1915, spending some five or six weeks in seeing different parts of Canada. The Minister is informed that great interest is being taken by men prominent in financial and social circles in the intended visit. There seems little doubt at present that it will be a very representative and important party of exploration.

Wage Reductions.—One who has been spending some time in a number of industrial centres of the United States says that it would not be surprising if wage reductions become general there before long. In iron and steel circles there is a belief that the independent steel companies will reduce wages, and it is thought that this tendency will shortly spread to the building and other trades, inasmuch as there is not sufficient work in sight to give employment to all. He offers the view that a similar development is likely to take place in Canada.

The Poulsen System of Wireless will probably be in operation early next month between Great Britain and Canada. Two stations, one at Ballybunion, County Kerry, Ireland, and the other at Newcastle, N.B., are now being fitted with powerful apparatus. The new company proposes to give the public a service at eight cents a word, and the press at four cents. The company under contract with the Canadian Government is the Universal Radio Syndicate and under this arrangement the all-British Empire telegraphic route will be complete.

Steel of Canada Annual.—The annual meeting of the shareholders of the Steel Company of Canada was held in Hamilton on April 27, when the following officers were re-elected:—C. S. Wilcox, president; C. A. Birge, vice-president; Robert Hobson, vice-president and general manager; directors, Charles Alexander, Providence, R.I.; W. D. Mathews, Toronto; John Milne, William Southam, Hamilton; Sir Edmund Osler, Toronto; F. H. Whitton, Hon. William Gibson and Lloyd Harris, Brantford; S. H. Champ, secretary-treasurer. The directors' report, which stated that last year was the best in the history of the company, was adopted. It was stated that the plant was just now running irregularly, but

the opinion was expressed that the change in the tariff would benefit the company.

Algoma Steel Corporation.—New high records in the production of pig iron rails and coke were made by the Algoma Steel Corporation during March. The production of pig iron was 30,420 tons, as compared with the previous record of 29,800 tons in April, 1913; of rails, 29,640 tons as compared with the previous record of 29,200 tons last July, and of coke, 40,760 tons, as compared with the previous record of 37,600 tons in January, 1913. This month the corporation received an order for 10,000 tons from the Grand Trunk Railway, at 50 cents per ton over the price paid by competitors. The corporation is now the one Canadian steel plant running full at the moment, and is likely to run full for some time ahead. With orders in sight, the corporation's output bids fair to be covered until September.

Coal for Government Railways.—Following up the purchase by Mr. Gutelius of American coal for the Intercolonial Railway last autumn, Hon. Dr. Reid, Acting Minister of Railways, announced in Parliament on April 27, in response to an inquiry by Mr. E. M. Macdonald, of Pictou, that Mr. Gutelius had asked the following firms in the United States to submit offers for the supply of coal for the Intercolonial and Prince Edward Island Railways for the coming year, 1914-15:—J. Bert Russ, Buffalo; American Steel Co., Pittsburgh; Moreland Coke Co., Pittsburgh; Ernest Law & Co., Philadelphia; Keystone Coal & Coke Co., Philadelphia; Walkins Coal Co., Philadelphia; Pennsylvania Coal & Coke Co., New York; George Hall Coal Co., Ogdensburg; J. W. Weaver & Co., Philadelphia; Whitney & Kemmerer, Philadelphia; the Grain Coal Mining Co., Buffalo, and H. W. Somers, Albany.

Welland Machine & Foundries, Ltd.—The annual meeting of the Welland Machine & Foundries, Ltd., was held at the company's office on Friday, April 10. The business transacted in the past year was quite large, and a very satisfactory report was presented to the shareholders. The directorate was authorized by the shareholders to proceed with the erection of the new foundry building, which is now necessary owing to the increased business. The new structure will be directly north of the present plant, and the Grand Trunk Railway are altering the sidings to suit the new conditions. Plans are already drawn, the contract will be let immediately, and construction will proceed rapidly. Following are the officers and directors for the ensuing year:—President, David Ross; vice-president and general manager, Wm. Edestrand; secretary-treasurer, B. J. McCormick; directors, D. Ross, Gordon Ross, Wm. Edestrand, B. J. McCormick and Edward Hooker.

Tenders

Tottenham, Ont.—Tenders are being called, until May 8, for cast iron pipe, valves, water tank, engines and pumps. Plans and specifications may be obtained from the office of the engineers, James, London, Hertzberg, Toronto.

Toronto, Ont.—Tenders will be received, addressed to the chairman of the Board of Control, City Hall, up to June 2nd, 1914, as follows: For the complete construction of a reinforced concrete bridge on Crawford street, over Bellwoods Park. Specification and tender form may be obtained upon application at the office of the Railway and Bridge Section, Department of Works, City Hall.

Toronto, Ont. — Sealed tenders, addressed to the secretary-treasurer of the Board of Education, will be received until May 12th, 1914, for wood working tools and equipment for Riverdale Collegiate manual training department; supplying science apparatus and chemicals for collegiate institutes; supplying machinery and other equipment, science apparatus, chemicals, etc., for Technical School; supplying science apparatus and chemicals for High School of Commerce. Specifications may be seen and all informations obtained at the office of the Clerk of Supplies, City Hall. W. C. Wilkinson, secretary-treasurer.

Kamsack, Sask.—Tenders will be received by the sec.-treasurer until Wednesday, May 13th, for the following works: — (A) — Labor, laying water mains and sewers; (B) — Power house and filter house; (C)—Furnishing materials for, and erecting water tower; (D)—Furnishing cast iron water pipes; (E)—Furnishing fire hydrants and valves; (F)—Furnishing and installing pressure filters; (G)—Furnishing and installing pumping machinery; (H) — Furnishing and erecting boilers; (J)—Furnishing and erecting steam engine; (K)—Furnishing and erecting generator; (R)—Labor and material for construction of concrete reservoir; (S)—Furnishing sewer pipe; (T)—Construction of concrete walk; (X)—Labor and material for construction of sewage disposal works. Alternative bids will be received for gas producers and engines in place of boilers and steam engine, and of same capacity. Plans and specifications may be seen at the office of Chipman & Power, engineers, Toronto and Winnipeg, and at the Town Hall, Kamsack. A. A. Crawford, sec.-treas.

Building Notes

Camrose, Alta.—R. A. Lister & Co., of Dursley, England, and Toronto, Ont., have built a warehouse for gasoline engines and "Melotte" cream separators.

Toronto, Ont.—A building permit has been issued to Dennison & Stephens, architects, for a five-storey brick warehouse to cost $82,000.

Toronto, Ont.—A large seven-storey factory and warehouse, to cost about $100,000, is to be erected at the southwest corner of Portland and Adelaide streets.

Toronto, Ont.—The United Drug Co., secured on April 22, a permit to erect a five-storey manufacturing building on Broadview avenue south of Queen street, to cost $125,000.

London, Ont.—The Ford Motor Co., have practically decided to purchase a site 102 x 330 feet, on which they will erect a four-storey building at a cost of $100,000. The building will be used as a warehouse and service station.

Toronto, Ont.—A twelve-storey office building is to be erected at the southwest corner of Toronto and Adelaide streets to cost at least half a million dollars, for the Excelsior Life Insurance Co. Tenders will be invited in a few weeks' time.

Toronto, Ont.—The Andrew Wilson Wholesale Tobacco Co., have asked tenders for the erection of an addition to the old Minerva Building at 10 Front street west. The addition to be built will be a steel fireproof structure and will cost between $75,000 and $10,000.

Toronto, Ont. — The Canadian J. H. Parker Co., of this city, has secured the contract of building the new Connaught Hotel, which will be erected on the Waldorf Hotel site. The contract calls for a $600,000 building, with a frontage of 102 feet. It will have eleven stories, and will be of brick, steel, and fireproof construction.

New Incorporations

The Favary Tire Co., Ltd., has been incorporated at Toronto, with a capital of $5,000, to manufacture various kinds of tires, etc., at Toronto. Incorporators—F. Kitching, F. V. Clisdell and A. W. Briggs, all of Toronto.

The Canadian Expansion Bolt Co., Ltd., has been incorporated at Toronto, with a capital of &40,000, to manufacture expansion bolts and appliances at Toronto. Incorporators—J. A. Kent, J. H. McDonald and E. W. Wright, all of Toronto.

Concerning the Practical Metallurgy of Tool Steel

By J. Pedie Sanderson, B.A.Sc.

The metallurgy of iron and steel and particularly tool steel is usually couched in language that the man who must devote himself to its working and using cannot readily understand. It is the purpose of this article to give scientific reasons for the behavior of tool steel under the conditions met with by the toolsmith in as simple words as possible.

IN 1740, Huntsman introduced his method of melting blister steel in crucibles and gave engineers cast steel, a good uniform metal with which to form their turning tools. When suitably treated, it was very satisfactory from the standpoint of hardness but had little stability and gave out if its working temperature rose above a certain point. This, of course, strictly limited its cutting efficiency, yet for 130 years it was the only tool steel available. In 1870, Mushet made his renowned discovery that, by the addition of tungsten to Huntsman's steel its ability to stand high cutting temperatures was enormously increased. Since then, chromium, vanadium, molybdenum, cobalt, nickel and other elements have been added separately or in combination, with the result that we now have our modern high-speed steels.

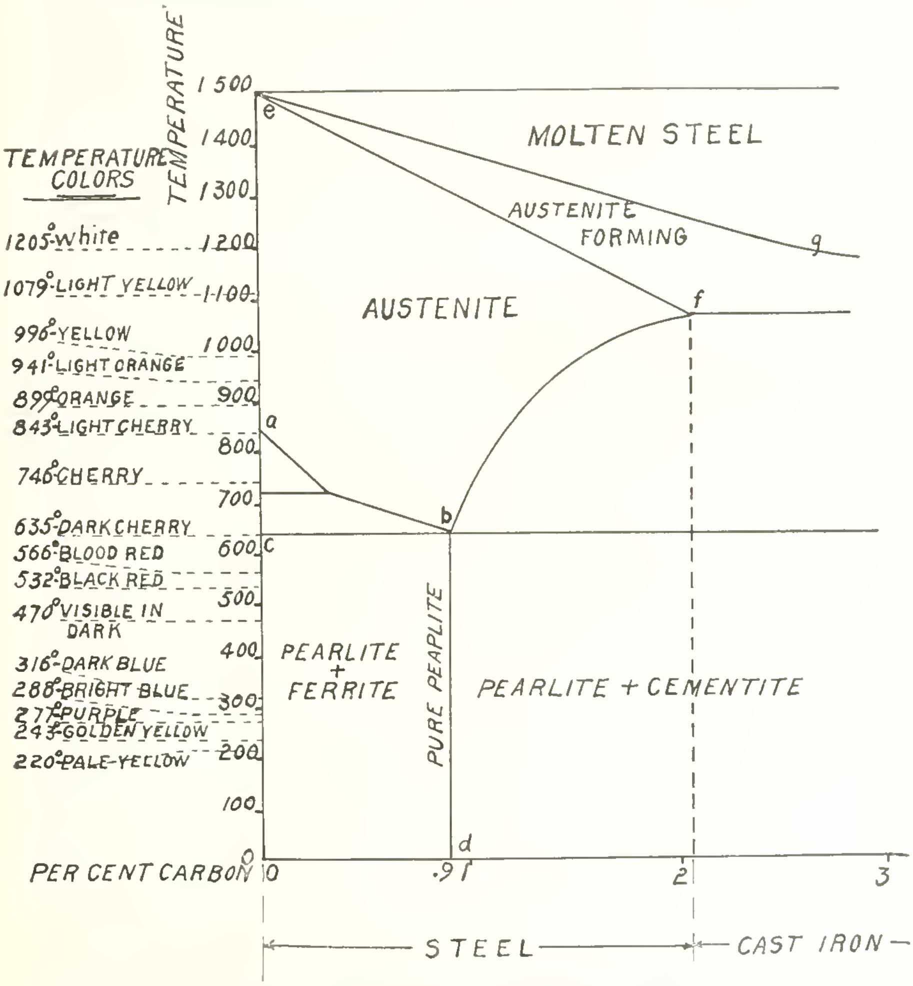


DIAGRAM SHOWING EFFECT OF CARBON PERCENTAGE UPON TEMPERATURES AT WHICH DIFFERENT CHANGES TAKE PLACE.

The words iron and steel refer to compounds of iron with some other substances. On account of the fact that iron is never found in its pure state, it has been necessary to give to absolutely pure iron another name, hence it is called ferrite. The chief substances which naturally associate themselves with iron are carbon, silicon, manganese and sulphur. The carbon is by far the most important and, in considering the hardening of steel we shall discuss its effects alone. The nature of the compound is governed independently and completely by two things, viz:—The amount and condition of the carbon content and temperature.

Carbon.

Irons containing a very low percentage of carbon are classed among the mild steels. As the percentage is increased the steel becomes less and less workable and is more and more easily hardened until this quality reaches its maximum at .9 per cent. of carbon. If the carbon be still increased, the hardening becomes again more difficult and the nature of the metal more granular and brittle until with about 2 per cent. of carbon, the cast irons begin, and may continue until a carbon content as high as 6 per cent. is reached.

Temperature.

To study the changes in consistency due to temperature we begin with molten steel, which is simply cast iron from which most of the carbon and other impurities have been burned out or removed in some other way. It first solidifies, but the carbon remains dissolved in it. Its color is white and it is known as Austenite. At a temperature of between 900 and 700 degrees centigrade, the different constituents separate out; it ceases to be a solution, and under the microscope it has a mottled appearance very much like concrete. If cooled slowly, this process is complete at 700 degrees C.

Chemical Compounds.

In steel, the carbon is either in solution, or is in the form of a chemical compound, while cast iron may contain some in the form of free carbon or graphite. The chemical combination of iron or rather ferrite with carbon is called cementite. The combination of ferrite and carbon in steel which contains .9 per cent. of carbon and which hardens at the lowest temperature is called pearlite. If the steel contain less than this amount of carbon it consists of a mixture of ferrite and pearlite; if it contain more, the carbon constituent is in excess, hence it consists of a mixture of pearlite and cementite. Another name for steel in the pure pearlitic condition is hardenite, which name is, of course, due to its peculiar quality. As the proportion of carbon is still further increased, the metal loses its steel characteristics and becomes a mixture of cementite and graphite commonly known as cast iron.

It must be remembered that any chemical changes brought about by heat require more or less time; thus, it takes some time to change ice to water. The temperature of the water can be quickly raised to the boiling point, but again a sensible amount of time is required to change the water to steam. The same is true of steel. In order that chemical and structural changes due to tempera-

ture may work themselves out fully, the metal must be heated or cooled very slowly.

Consider a quantity of steel being thus cooled from the molten state. It first solidifies but does not change in any other way. This so-called solid solution is known as austenite and is hard and granular. As the steel is cooled down further it becomes soft and tough in texture and when cold is called annealed steel. This change begins at about 900 degrees C. and is completed at 690 degrees C. and this is known as the "recoalescence" period.

The Roberts Austin's Diagram.

Upon the diagram, the temperatures at which the above take place are represented by the lines (ab) and (bf) for the upper limits and (cb) as the lower limit or completion of the process. It will be noticed that the recalescence temperature is lowest at (b) or when the carbon content is .9 per cent., and rises rapidly with a steel of either less or greater carbon percentage.

The process of solidifying begins at temperatures represented by the line (eg) and is completed at those represented by the line (ef).

Hardening of Steel.

As already stated, these changes consist of the separating out of the pearlite, cementite (iron carbide) and ferrite, constituents of the steel, and this requires time. If a piece of steel containing say .6 per cent. of carbon be heated above its recalescence temperature, that is, until it is in the austenite condition, which, from the diagram is 740 degrees C., and is suddenly cooled in water, there is not time for the annealing process and the steel retains the characteristics of the austenite which is a hard and flinty solution.

At the recalescence temperature also, the size of the grain begins to increase. The higher the temperature above the critical point at which the steel is quenched, the coarser the grain will be. to refine the grain, heat carefully up to the critical point and no higher, and allow to cool or quench as desired.

Sir Frederick Abel and other experimenters in 1885 discovered the definite existence of iron carbide Fe_3C as a chemical compound, and showed that the hardness produced by tempering was directly related to the percentage of the total carbon present in this form. When tempered to a straw color, about 35 per cent. of the carbon would be present in the form of the carbide; when tempered to a blue color, it would contain 42 per cent. and when in the hardened untempered condition, it would contain about 96 per cent. of the carbon as carbide of iron. Here, then, was the secret of tempering, namely, the reduction of the iron carbide of pearlite to the proper percentage by reheating. When steel tools were overworked, they become heated; the carbide of iron was formed freely, the tools became soft and the edges broke down.

Effect of Tungsten, Chrominm, etc.

The addition of tungsten, chromium, etc., to carbon steel produces the self-hardening and high-speed steels. The practised toolsmith knows that, by merely allowing these steels to cool gradually in dry air from different heats ranging from a cherry red to a reddish-white, all tempers may readily be obtained. The explanation of the effects of tungsten has been very recently investigated by Professors Arnold and Reid, who have found that, as the percentage of tungsten was increased, the possible formation of iron carbide became less and less, and a combination of carbon and tungsten or tungsten carbide was formed instead. With about 11.5 per cent. of tungsten, the iron carbide disappeared entirely and thus this amount of tungsten forms the lower limit of this metal in modern high-speed steels. High-speed steel then, is one in which there can be no formation of iron carbide, and thus there will be no tempering effect until the formation of tungsten carbide which takes place at a much higher temperature and which in self-hardening steels produces no softening at all.

High-Speed Steel.

The superiority of high-speed steel is therefore not due to a greater degree of hardness, but rather to a greater thermal stability; that is, it will stand up and work at much higher temperatures. With a tool of Huntsman's steel, Prof. Arnold found that 16 cubic inches of steel could be removed before the material of the tool gave way. Under exactly similar conditions, he found that 900 cubic inches of the same material could be removed by a modern high-speed steel tool.

The knowledge of the chemical reactions of the different combinations of tool steel may seem unimportant to most engineers and tool makers, but the fact remains that all great advances in its quality have been preceded or accompanied by discoveries in the metallurgical field. At any rate, now that the why and the wherefore of steel up to the present time have been found out, it is in order for some new discoveries to be made.

The Rope Drive as a Power Transmission Medium

By E. H. Ahara, Mishawaka, Ind.

Being an abstract from a paper read before the American Society of Mechanical Engineers, covering a series of tests on the transmission of power by rope-drive under various conditions.

CONCLUSIONS deducible from the data obtained seem to show that the efficiency in rope driving is considerably greater at the lower speeds than at the higher ones, the dropping off being especially noticeable above 4,500 ft. per min. of rope speed. They also show that the efficiency of a rope drive is not materially affected by distances between centres up to 150 ft., that the drop of

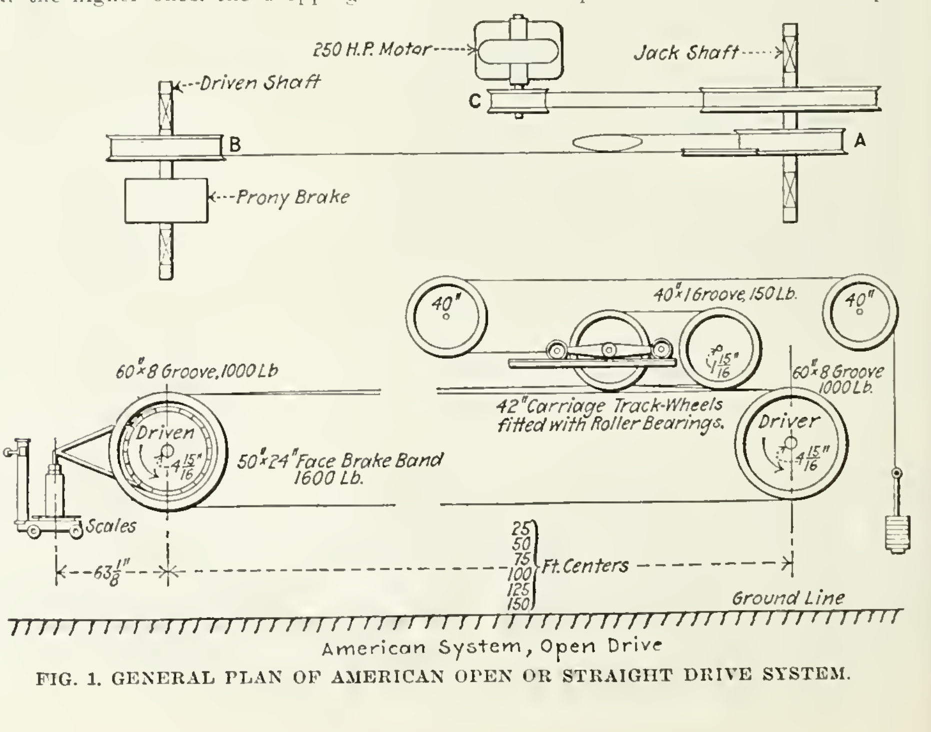


FIG. 1. GENERAL PLAN OF AMERICAN OPEN OR STRAIGHT DRIVE SYSTEM.

efficiency at 50 per cent. load is comparatively small over that of full load, and that if proper care be exercised to have all grooves perfect in pitch diameter, many as well as few ropes can be run on a drive with good efficiency. With the American system, increasing the slack rope tension up to 360 lb. in a 1-in. rope does not appear to decrease its efficiency, but rather to increase it, if power be used in conformity with this tension; but only such tension should be used as is necessary to drive the load needed.

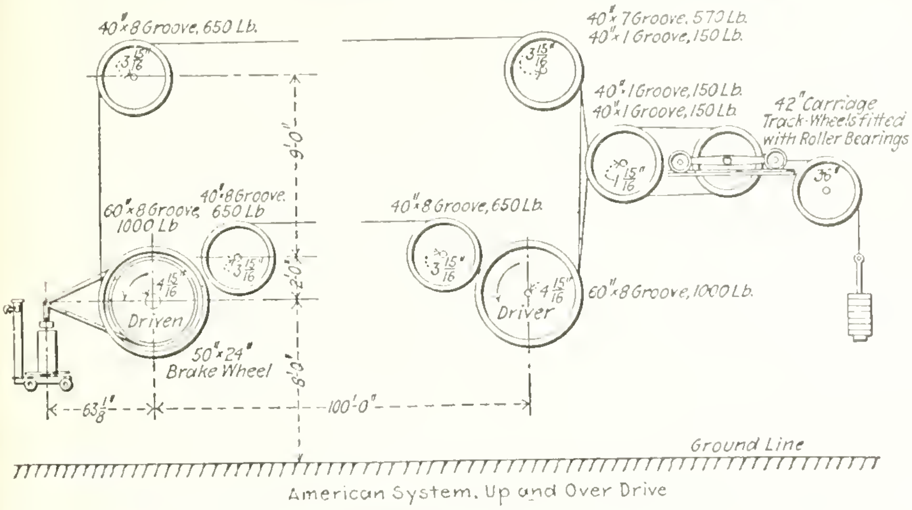


FIG. 2. GENERAL PLAN OF AMERICAN UP AND OVER, OR INDIRECT DRIVE SYSTEM.

The efficiency was measured under full, three-quarters, one-half and one-quarter loads, while one-inch best Manila rope was used. The tests cover drives of from one to eight ropes, with centres from 25 to 150 ft., on both American and English systems; also open or straight drives, as well as indirect, or up and over drives. For the rope tested the American system has very much more capacity than the English system, and has also a higher percentage of efficiency. In general it would appear that, where there is a considerable power to be transmitted, the properly worked out rope drive gives a most efficient and economical method, and where conditions are favorable to its installation no other known method of transmission will so well conserve power losses.

The efficiency as determined includes the losses in the rope itself, the friction in the bearings on the driven shaft, and the losses due to the inertia of the driven wheel and the prony-brake wheel, and, also, in the American system, the friction of the tension equipment. All tests were made to include the friction of the receiving shaft and bearings as it was thought this would more nearly approximate working conditions and make the data obtained of more general application in ordinary comparisons. All bearings used were of the ring oiling babbitted type, and the ropes were all 1-in. Manila rope of best quality, carefully treated with a rope dressing to prevent the entrance of moisture and to keep the surface in as nearly uniform condition as possible. It was found during the test that this was of great importance as very slight changes in the rope surface immediately affected its capacity and efficiency.

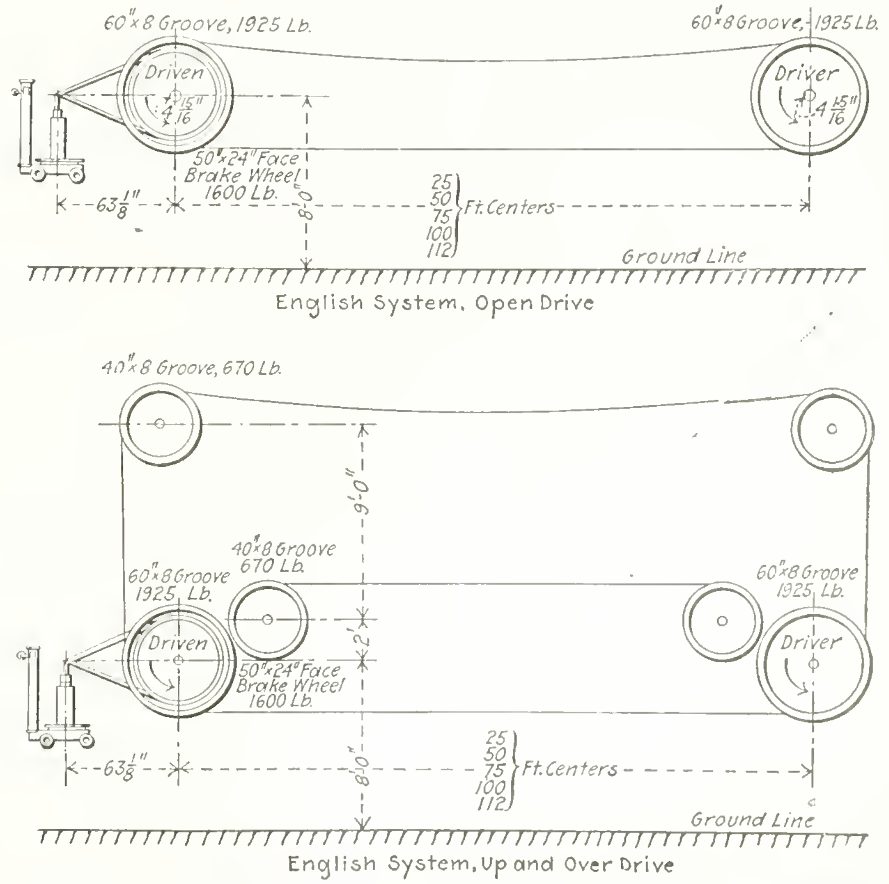


FIG. 3. PLAN OF ENGLISH OPEN DRIVE AND "UP AND OVER" DRIVE SYSTEMS.

With the American system, a lower efficiency is shown on the lower number of ropes. This is undoubtedly caused by the fact that the eight-grooved wheel made for testing eight ropes was used for all the lesser number of ropes to avoid the expense of making additional wheels with a suitable number of grooves for each drive. This together with the weight of the prony brake increased the proportional friction on the smaller loads, and is, therefore, a larger percentage of the total load in the drive of few ropes. With the friction of driven shaft eliminated, limiting the losses to those in the rope alone, it is believed the efficiency in a single rope would be as great, if not greater, than any multiple thereof.

In all of the above tests the tension of the slack side of the rope was kept as uniform as possible at 180 lb. by means of weighing the tension carriage properly. In order to ascertain what tension would give the greatest degree of efficiency, irrespective of life of rope or wearing qualities, a test was made with the slack rope under varying tensions. This was determined on one rope because the capacity of the single rope was, under the heavy tension, as great as that of the motor, so no proper comparison could be obtained on more than one rope.

Groove Pitch Feature.

One of the greatest troubles in rope driving, when installed by inexperienced

engineers, has been the lack of uniformity in pitch of the grooves where many ropes were used. This differential in the grooves compels slippage of the ropes which not only causes loss of power, but also rapidly depreciates the rope, and often causes the rope to flop around badly. To test the loss of efficiency in this case, two wheels 60 in. in diameter, of eight grooves each, were made up exactly alike so far as could be, and after most careful measurements the grooves on either wheel were found not to differ more than 1/64 in. in circumference from any other on the same sheave, and a test made. The driver was then removed, and the pitch diameter of each groove made approximately 1/32 in. less than the preceding groove so the eighth groove was 1/4 in. less in diameter than the first one.

Again, it was placed on the driving shaft and a duplicate set of tests made. In this test as the first groove was 1/4 in larger in pitch diameter than the eighth groove, with the sheave revolving at 160 r.p.m., there would necessarily be a slippage in an inelastic band of over ten feet per minute. The photographs taken of this differential drive, show plainly the sag of the various ropes under this condition, and how, under heavy load they stretch and slip in the grooves of the sheave. The elasticity of the rope in this case undoubtedly lends itself to aid efficient operation.

Test Procedure.

The "up and over" American drive was tested because it is typical of all but direct drives, i.e., straight from driver to driven, and the difference in efficiency between this type and the open drive will serve as a basis of comparison where but two additional right-angle turns are introduced requiring four additional idlers. This test was run on approximately 100 ft. centres with a new rope, the same rope being afterwards used in the testing of the various English drives.

In testing the English drives, in order that proper comparisons be made, the ropes were all cut to the same measured length, and the splices carefully made, so that all ropes might be equally tight when applied to the sheaves. The movable tower was then carefully moved back, the rope being run slowly meanwhile until the sag in the rope was approximately the same as in the American drive of the same centre distance in which the slack rope was under a tension of 180 lb. This is undoubtedly a higher tension than is used in general practice on the English drive system with this size of rope, and the capacities and efficiencies shown are perhaps higher than are ordinarily attained in common practice. The efficiencies, when compared by speeds, of the English open drive show a marked decrease as the speed of the rope increases, falling as low as 84.5 per cent. at 5,500 ft. rope speed.

The general tendency in all tests made, both English and American, was corroborative of this tendency toward decrease in efficiency as the speed of the rope increases. There was, however, a lack of smoothness to many of the curves owing, it was thought, to variations in rope tension, and perhaps slight changes in the surface of the rope due to climatic changes. This was very much more noticeable on the English than on the American system, the irregularity of the curve on the former being affected by the fact that a greater load was sometimes attained on a certain speed than could later be reached on the next higher speed. The efficiency of the English drive, within the limit of distances tested, remains practically constant irrespective of centre distances; while with reference to number of ropes, it increases as does the American for the first few ropes, and then remains practically constant through the additional ones.

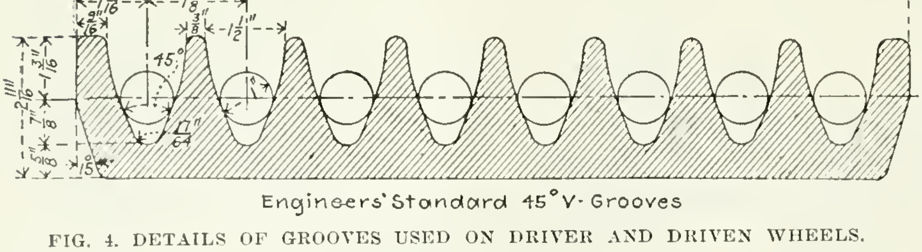


FIG. 4. DETAILS OF GROOVES USED ON DRIVER AND DRIVEN WHEELS.

In order to test the effect of tension on the English system, a comparison was made by moving the receiving tower forward 1 1/4 ft. after making a series of tests, and then making another corresponding series. When sheaves with proper English pinch grooves, as shown in Fig. 4, were used, there was no appreciable difference either in power transmitted or in efficiency. Greater variations than 1 1/4 ft. in centre distances could not be satisfactorily tried because of the slack ropes dragging on the ground.

A new rope was used on the American open drive, another new one being started with the American "up and over," which latter was also used on both the English drives. The time of introducing the new rope is mentioned because it was found that a new rope had very much less capacity, owing to its low coefficient of friction, than the same one had after it had run a short time in work, and having less capacity it would usually have less efficiency also. The stiffness of the rope when it was new also seemed to add friction to the drive owing to the bending action in passing around the sheaves, which on the test were only 60 ins. in diameter. With larger main drive wheels, where the rope is not bent to so small a radius, the efficiency would undoubtedly be slightly increased over the results here shown.

Rope Drive Capacities.

The capacities of rope drives are affected by so many variables that no particular attempt is here made to state capacity other than in general figures.

Limiting capacities obtained are in no sense to be considered as available working capacities, but merely as limits reached in driving capacities, the practical working capacity being much lower than the limits reached. It is to be regretted that the power available was not great enough to get the larger capacities, as so few points were obtainable on the American open system. Even at the low speed of 2,500 ft. four ropes could not be made to slip with the 250 h.p. available.

The irregularities of these limiting horsepower capacities are caused by many variables, some of which are weather, surface conditions of rope, condition of rope wheel grooves, etc. In connection with the groove in the wheel, it was found that if a rope began to slip in a groove and warmed it up slightly, the coefficient of friction seemed to decrease very rapidly, and if a limiting test were made under these conditions it was invariably much lower than if it were taken just before the rope started to slip. As each test had to be taken in its scheduled order, some of those dealing with limiting capacities were taken at intervals of several weeks.

As the limiting capacities of the English drive are very much lower than the American, it is thought the efficiency is likewise affected, the friction in the former case being a much larger proportion of the power delivered. Again, the English system in order to get driving power in the rope, pinches it in the narrow groove, requiring considerable force to withdraw it again. This effort being exerted continuously uses up considerable power. The American system, on the contrary, uses a 60-deg. groove, in which the rope lies freely and withdraws without effort.

DESIGN AND STRENGTH OF WORM GEARING.

By A. Best.

MUCH has been said at the meetings of our engineering societies, and much has been written in journals and text-books on the subject of gear strengths, but one may still look in vain for a simple solution to the problem of what power a given worm gear will safely transmit.

All gearing should be designed with a fair factor of safety, and in most cases now the size of the gear is more or less determined by the nature of the load: whether subject to shock or fairly steady. Another influential factor is the length of life expected from the gears. These conditions naturally cause the designer to get well beyond the point of destruction. It is found then that gears are really designed for wear, and it is, therefore, desirable to watch those points which, though they do not seriously increase the weight or cost of the gears, allow more accurate meshing. The consequences are—smoother running and longer life.

It may, perhaps, be imagined that by using a greater width of wheel face, an increased power can be taken through the gears. This is true only to a limited extent, because as the wheel gets wider, the diameter of the pitch surface at the sides of the teeth gets greater, and as a consequence the pitch is greater. When this increase is very great, the gears cannot mesh properly at those points, and inaccurate meshing, owing to the wheel teeth getting out of pitch, causes considerable friction and rapid wear. This fault often causes the excessive generation of heat. Gears overheated can frequently be remedied by reducing the angle of throat. When this throat angle is not allowed to exceed 70 degs., then the increase in pitch is not sufficient to seriously impair the working of the gears.

Another point to watch is the length of the worm, and if the latter be made of such a length that the ends are clear of the outside diameter of the wheel (at the bottom of the throat radius), there will be no fear of the rattle which is sometimes heard, when the ends of the worm threads strike suddenly into the wheel teeth instead of smoothly sliding into mesh. It has been said that this worm is too long—owing to the law that no tooth contacts can take place out of the line of action. This is all very well for a new pair of gears, but when wear has taken place, matters are slightly altered.

Chart Feature.

With regard to the strength of worm gears, the accompanying chart will serve to solve this problem for bronze worm wheels. Bronze wheels give the most satisfactory results—either solid bronze gears, or cut bronze rings shrunk on cast-iron centres.

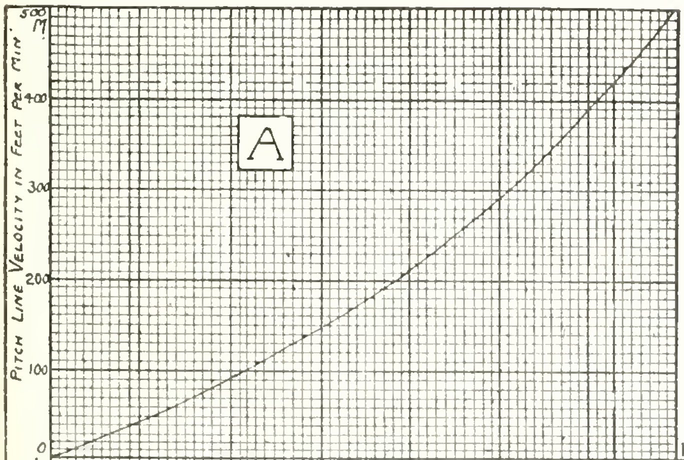
To use the chart it is first necessary to assume any worm and wheel to give the reduction required, then proceed to find by the chart if the assumed gear is suitable for the power which it is intended to transmit. If not, the pitch or pitch-line diameter of the worm should be altered until the required power is obtained.

Next calculate the pitch-line velocity of the worm wheel as follows:—

$$\frac{\text{Pitch ins.} \times \text{No. teeth} \times \text{revs. per 10 in.}}{12}$$

= Pitch line velocity in feet per min.

Then find the position on the axis (L M) for the value obtained. Follow this horizontally to the curve in graph (A), down the corresponding ordinate and cross axis (L K) to the line in graph (B), marked with the linear pitch of the worm. Proceed horizontally across (K N) to the line in graph (C), representing the pitch-line diameter of the worm used. The point on the axis (N P) vertically under this will give the horse-power for which the gears are suitable. The method is based on the proposals put forward in this article, and will be found ready and reliable.—Page's Weekly.



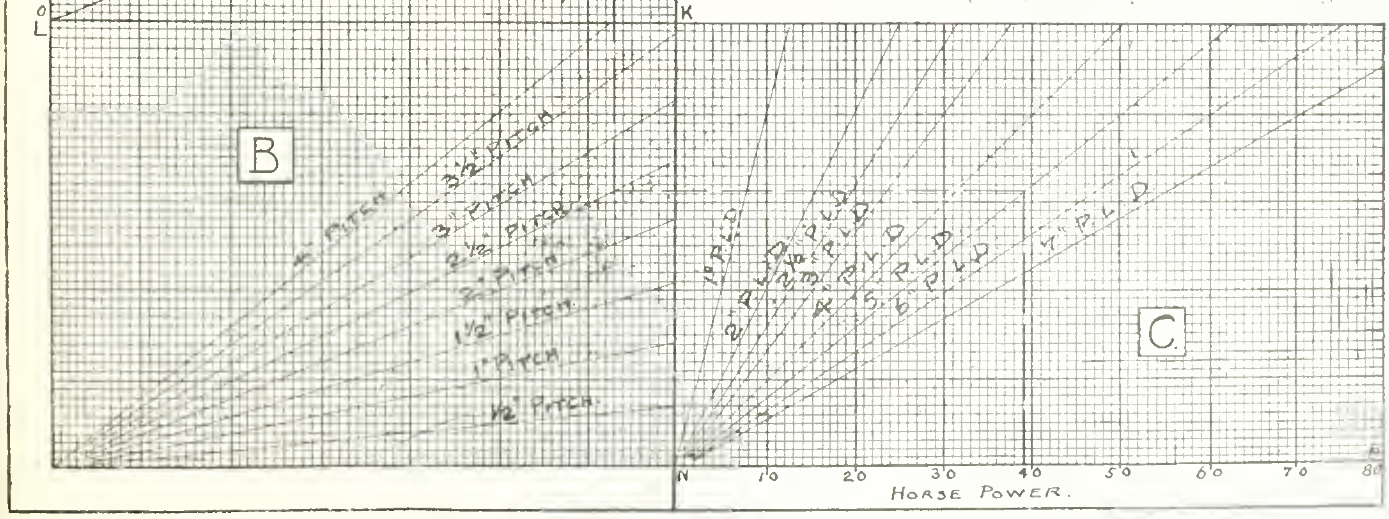


CHART FOR HORSE POWER TRANSMITTED BY WORM GEARS

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

STAMPING DIMENSIONS ON SHOP TOOLS.

By James E. Cooley.

THE necessity of stamping dimensions on shop tools can never be realized until one begins to observe how much unnecessary remeasuring is done in handling: how much time is wasted in this way, and how expensive it really is, when we consider the number of employees engaged in this practice. Take for example a planer-hand who, setting up work on a planer, requires a bolt of a certain diameter and length, and a straddle a certain width across the opening. He will pick up several of these parts and measure each one until he finds those wanted. This act of measuring is not confined to one particular job, but is repeated on nearly every job set up, and if the diameter, thread, and length were stamped on the bolt, and on the straddle, the distance across the opening, there would be no need of measuring these tools each time when needed.

When we consider this one little feature, where re-measuring is required, and see not alone one planer-hand, but practically all others employed doing this same thing, and repeating it often in the course of a year, the waste of time begins to assume big proportions. If the time wasted in re-measuring unstamped shop tools by one class of operators is of considerable proportions, how much greater is it when one considers lathe hands, drill press hands and other machine operators doing the same.

A lathe hand requires a new bolt hole in a face-plate on which to strap a piece of work. He drills a hole, taps it out, and is the only one that knows the diameter of hole and pitch of thread. Later on another workman desiring to use the same hole pulls out his scale and measures the size. He finds a bolt the right diameter, but with the wrong pitch of thread. He forces this into the hole and strips the thread, and, of course, a new hole must be drilled and tapped out. Thus it is seen that if the diameter and pitch of thread were stamped on holes in face-plates a good deal of time and expense would be saved. Considerable time is usually required to set up machinery, to arrange fixtures, to strap down parallels, to bolt down angle-plates, etc., but the greater part of this time has been taken up in measuring those parts in use which have been previously used over and over again and measured each time when handled. This routine will continue as long as shop tools remain unstamped or have nothing on them to indicate their size.

A certain manufacturer, referring in a humorous way to one of his employees, said, "that he never saw him doing anything, but he was always getting ready to." This "getting ready to" is the time mostly spent in the needless measuring of tools. If workmen were given drawings to work to, having thereon no dimensions, necessitating the measuring of the parts shown in the sketches, we would think it a peculiar and expensive method of doing work; yet this is exactly what is being done in the way of handling a great many shop tools. It is necessary to measure them in order to find out their thicknesses, widths, diameters, etc., before they can be used.

Rows upon rows of parallels of various thicknesses and widths are kept in order on shelves and racks for use on milling machines and planers, and not one of them can be found containing a mark of any kind to indicate its size. How often is it necessary to run the jaws of a lathe chuck clear out to see if they will take in work of a certain diameter, when the limit of capacity could be just as well stamped on the chuck to save repeating this operation. A careful and systematic study of the various machine tools and appliances that are measured and re-measured each time used will convince anyone that a great saving in time and labor can be effected.

Another point that needs to be mentioned in regard to stamping dimensions on shop tools is the inadequate supply of "sets of figures" noticeable in the average machine shop. Of all supplies kept on hand in stock or tool-room, the least of these are "sets of figures." Taps, drills, files, and all these necessary things are bought in liberal quantities, but not so these "figures." It will, therefore, become necessary in order to make any noticeable reduction in time and labor to keep on hand a sufficient number of "sets of figures," so they can be given out to workmen to use freely in stamping dimensions on tools, and thus eliminate the necessity of re-measuring. No shop tool, fixture, or any machine appliance is finished, and never should be put in use, until its dimensions are stamped on it. A reamed hole or a hole tapped out on an angle-plate should have its size stamped over it, as also every tool or fixture that some time or other will be used over again. Steel figures if liberally used are big time-savers, and occupy a place and distinction as such equal to that of automatic machinery.

HAND-PULL HOIST ATTACHMENT.

By Mac.

TO those interested in lifting material in shops, otherwise than by hand or with chain falls, I will describe the attachment we made to a 4-ton "Harrington" hand-pull chain fall. We used this lift outside our shop for loading and unloading. It ran on a trolley suspended from an 8-inch I beam supported on the building and on an arch 15 feet apart. When first erected, the only means of operating was by man-power, but as the loads were heavy and the weather cold, two or three men would quickly become tired, and the work was carried on slowly.

We had an air compressor in the shop to drive air hammers, drills, etc., and it set me thinking as to how to supply some sort of power to our hoist outside. An idea came to me, and I told the manager we could put a reversible motor on our chain fall and do the work of driving much quicker and cheaper. I explained our need of an air motor, a pinion and gear to try the scheme out. He was much impressed with the idea, having frequently complained of the time it took to do our loading.

The matter rested for some time; in fact, until an air tool traveler called; they visit us about once a month to keep in touch with the operation of the tools. The manager called me into the office to explain our needs. We went out to the shop and looked the hoist over, but aside from sending us down two small reversing drills or motors to try out, no great encouragement resulted from the interview. The smallest motor, with a speed of 750 r.p.m., was the one we selected to try.

I went to the forge shop, and from a 3/4-in. x 1-in. flat steel bar made a cradle with two clamps, one to clamp over the stuffing box spindle and the other over the throttle pipe, as it screws into the valve chamber of motor. This cradle I bent and bolted to the chain hoist where the hand chain guide yoke had been. I had taken off the hand sheave yoke, and as the whole arrangement was in the nature of an experiment, I did not want to buy any gears, so I borrowed two of the change gears for thread-cutting from one of the lathes. The pinion had 20 teeth

and the gear had 100 teeth, which gave me a ratio of 5 to 1.

The next problem was to fit the gears to the motor and hoist. I made a short tapered arbor, one end with a No. 2 Morse taper to fit the spindle of the air motor. The other end I turned and splined to fit the pinion, which I pressed and keyed on. I then threaded the bore of the cast iron gear to fit the sleeve on the spindle of the chain hoist. The air motor was next placed in the cradle and clamped tightly with the gears in mesh. After making a clamp yoke to fit the throttle with two long cords attached for operating, we hung the machine up to the shop roof, and tried it.

As the air drill was small and light, we did not expect a great deal, but it handled our heaviest weights without trouble. We then put it outside where it belonged, and connected it with the air-line through a hole in the wall with 25 feet of 1-in. protected rubber hose. We have lifted over three tons with it so far, and have had no trouble, except from the cold, when the valve freezes.

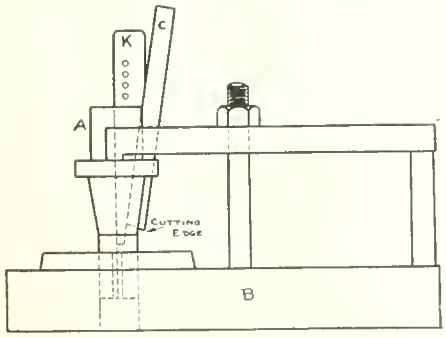
The next time the air tool traveler came he was interested in our hoist, but would not be convinced of its success until he had seen it in operation.

KEYSEATING MAGNETO GEARS.

By A. L. Loy.

IN the Jan. 1 issue of Canadian Machinery, a method was described of keyseating tapered magneto gears by sawing. The writer wishes to describe a different method of doing the same job.

The drawing shows the fixture used, without a gear in place. The base B has a finished pad on which the gear to be keyseated is placed. This pad is also bored out to receive the arbor A, corresponding to the small size of the taper hole. To prevent the arbor from turning, it is keyseated, a stationary key being provided in the base. The arbor is milled full length about half its depth to



KEYSEATING MAGNETO GEARS.

the same width as that of the key to be cut. A taper wedge, K, having the same taper as the arbor, is provided with a number of small holes in which a pin may be inserted to hold the same in place. The hardened cutter or drift, C, is driven down through the gear hub, the cutting edge being at the lower corner. After the first cut is taken, the tapered wedge is lowered a hole, and the cutter again driven through. About three cuts is sufficient for the ordinary gear, and it is surely surprising how quickly the operation may be performed. The clamp at the top holds the arbor firmly in the gear, at the same time clamping the gear to the base.

A PISTON CROSS-BORING JIG.

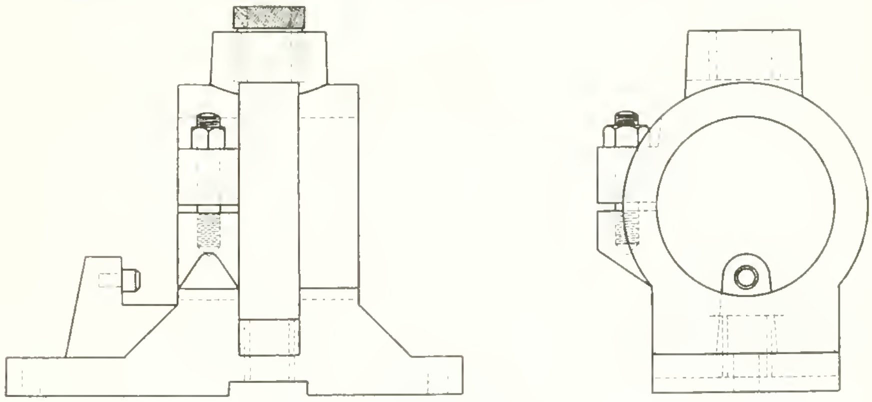
By D. S. Mann.

IN cross-boring gas engine pistons several different types of jigs are used, depending in many cases whether the cross-boring is the first or the final operation, and also whether the bosses are to be faced or not. In some cases box jigs are used, the piston being located by the open end; in others, an open type of jig is used, the piston being located in the same manner.

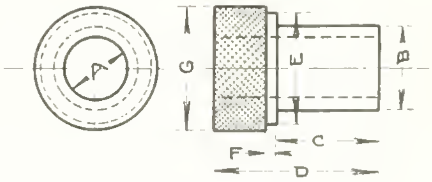
The jig shown in the drawing is of the open type, but since the cross-boring is the final operation and the piston has already been ground to size, it is held and located by the circumference. The jig comprises a single casting which is bored out to receive the piston, the part holding the piston consisting really of two rings across which on the top is a bushing provided for guiding the boring bars, while beneath is placed another bushing. Sufficient space is left between the upper bushing and the top of the piston so that the slip bushing will be down into place before the boring cutter enters the piston.

One of the body rings is split and used for clamping the piston, this being done back of the bosses on the closed end where the metal is thickest. The pistons are pushed into the jig, the closed ends striking the hardened steel stop pin which is placed the proper distance from the cross-boring. Pistons should always be located from the closed end in order to maintain the compression pressure constant when in the engine cylinder. In this particular case, the pistons had previously been rough-drilled and, when inserted in the jig, a tapered plug was pushed down through the upper fixed bushing centering the piston sufficiently close.

A double-cutter boring bar piloted in the lower bushing was first run through the pistons, the slip bushing shown in the drawing being used on the upper end. This was kept on the bar and was removed with the bar, the upper cutter lifting out same. A double reamer also carrying a similar slip bushing and piloted in the lower bushing was then run through for finishing. It should be stated that the holes in the sides of the pistons were not the same diameter, one being 1½ inches, the other 1⅝ inches. This enabled the cutter for the lower part of the piston to be slipped through the upper hole so that the feed of the bar was only that of the one hole. After the holes were reamed to size the bosses were faced, the cutter bar fitting the two previously reamed



PISTON CROSS-BORING JIG.



SLIP BUSHINGS.

A	B	C	D	E	F	G
1 1/16	1 7/16	1 1/4	2 1/16	1 5/8	1/16	1 3/4
1 1/8	1 1/2	1 3/8	2 3/16	1 3/4	1/16	1 15/16
1 3/16	1 5/8	1 1/2	2 5/16	1 7/8	1/16	2
1 1/4	1 3/4	1 1/2	2 7/16	2	1/16	2 1/8
1 5/16	1 13/16	1 5/8	2 9/16	2 1/8	1/16	2 1/4
1 3/8	1 15/16	1 5/8	2 9/16	2 1/8	1/16	2 1/4
1 7/16	2	1 3/4	2 11/16	2 3/16	1/16	2 3/8
1 1/2	2 1/8	1 3/4	2 11/16	2 3/16	1/16	2 3/8
1 5/8	2 1/4	1 7/8	2 7/8	2 1/4	1/16	2 1/2
1 3/4	2 3/8	2	3 1/16	2 1/2	1/16	2 3/4
1 7/8	2 1/2	2 1/8	3 5/16	2 3/4	1/16	3
2	2 3/4	2 1/4	3 3/8	3	1/16	3 1/4

SLIP BUSHINGS FOR PISTON CROSS-BORING JIGS.

holes with deep chip grooves milled in that portion of the bar which acted as a guide.

This style of a jig leaves the open end of the piston entirely free so that it is easy to insert the facing cutter and also to do any calipering necessary. The facing cutter was ground on both the upper and lower edges and, in use, stop collars were provided on the bar and the lower bosses faced accordingly, the proper spacing between the bosses being obtained by calipering. A felt washer was used on the lower end of the boring bars to prevent the chips working into the bushing.

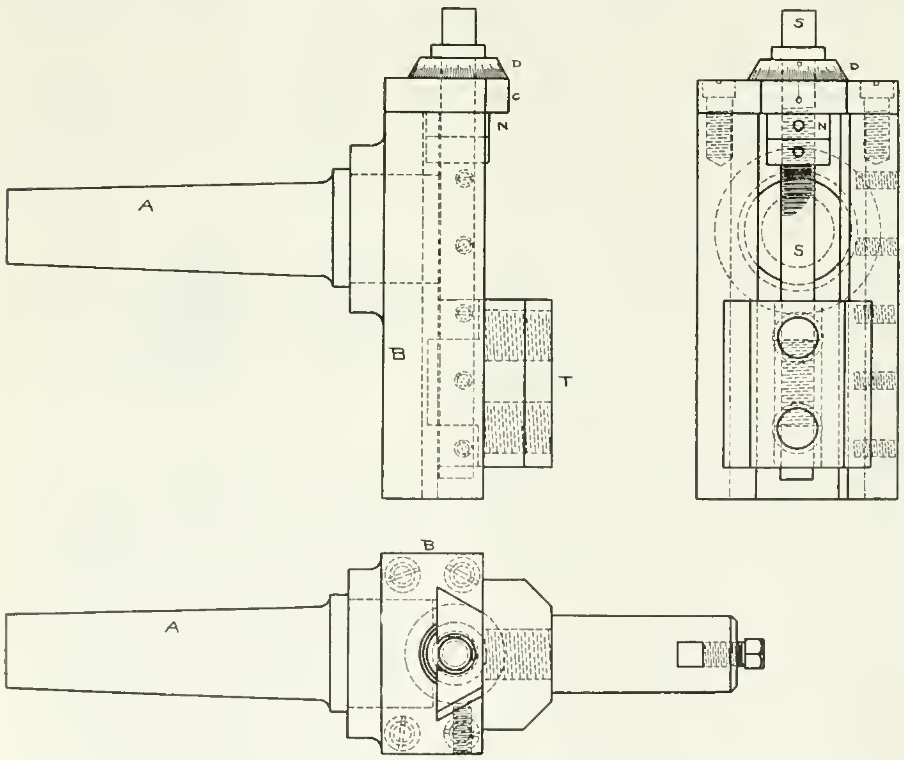
MILLING MACHINE BORING TOOL.

By D. O. Barrett.

THE accompanying drawing shows a very useful type of tool for boring on a milling machine. In the size shown, the taper of the shank was a No. 10 Brown & Sharpe. The shank A of the tool extends through the body B, which is bored out to receive same, and is then shrunk on. All parts of the tool are of steel. The body B is beveled out to take the tool holder T, which is provided with a gib on the one side, backed up and adjusted by the five headless set screws at the side. These screws are adjusted so that the block T is a neat fit in the body, and no clamping is then necessary.

The screw S is one-half inch in diameter, having twenty threads per inch. This extends through the end piece C, which is fastened to the body B by means of the four filister head cap screws. The dial D is graduated into fifty parts, which graduations will, therefore, read in thousandths of an inch. The two nuts N are used for taking up the end motion on the screw, and are each provided with holes in which pins may be inserted for turning. The outer end of the screw is squared so that a small wrench may be used on same.

The nut in the tool holder T does not extend the full length of the block, and the block may be readily removed by screwing entirely out. This block has two ¾-inch tapped holes, one at either end, in which bars are screwed and the cutting tool held in the end of same. In boring small holes, the bar is used in the inner hole, while for larger holes it is used in the outer hole. Bars of different lengths may be used, so that the range of the tool is quite large. With the tool shown, holes up to 9 inches in diameter may be readily bored.



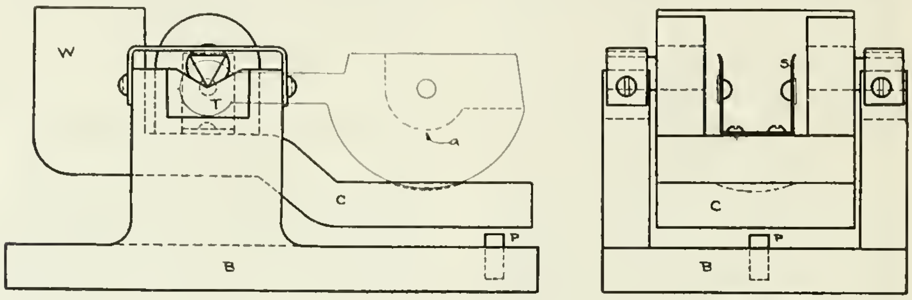
MILLING MACHINE BORING TOOL.

This holder is very solid, and its range quite large for its size, while the adjustments are easily made and extend over the entire range.

A GOVERNOR BALL-BALANCING FIXTURE.

By A. L. Loy.

THE fixture shown was used for balancing governor balls used on the governor of an oil engine. The ball is shown in the side view in the light line, and the desire was not so much to maintain the ball of a standard weight as to get all the balls on the governor of the same weight, there being three to each governor; and to prevent unequal stress, each of these should be of the same weight as the others.



GOVERNOR BALL BALANCING FIXTURE.

The base B carries two side pieces, in which are set the tool steel blocks T. Resting in these are the hardened knife edges which support the block C, in which the governor ball is laid. Riveted to the piece C is the heavy spring S, in which are two round-head hardened rivets, with the heads on the inside. These heads are located on the centre line of the knife edges, and the end of the governor ball is pressed down into the spring; these two rivets fitting in the already drilled hole. The large end of the ball rests in the depression. The weight W is arranged to balance the ball, the proper weight being obtained by drilling out. In order to maintain the balls uniform, a standard weight was made and retained for checking up the device at any time. The balls were made slightly heavier, and then drilled out at the point (a), the pin P taking the pressure of the drilling.

The Dominion Forged Steel Car Wheel Co., of Ottawa, which holds the patents for the manufacture of forged steel car wheels, is being organized with a capital of $1,000,000. The company is financed by English capital, and Mr. Dugald Ross, of Toronto, is making arrangements for the establishment of the plant here. The plant, according to present plans, will work up to a maximum requirement of 200 tons of steel per day. The company will employ between 75 and 100 men, and their annual pay roll will be in the neighborhood of $200,000.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Attention is drawn to the alternating course in arithmetic, a concurrent study of which is recommended with that of the Question and Answer Series.

PROBLEMS IN CENTRIFUGAL FORCE.

CENTRIFUGAL Force is the force which tends to move a body away from the centre about which it rotates. It is caused by the tendency of a body to move in a straight line rather than in a circle.

The formula for centrifugal force is

$$F = \frac{mv^2}{R}$$

In which m = the mass of the revolving body.

v = the velocity of its centre of gravity in feet per second.

R = radius = the distance between the centre of gravity of the body and the centre of motion.

For pulleys and other parts of machinery, this formula is best simplified so that we can use r.p.m. instead of ft. per sec., and weight in pounds instead of mass.

$$m = \text{mass} = \frac{W}{g}$$

where W = total weight of body in pounds.

g = value of the force of gravity = 32.16.

$$N = \frac{60v}{2 \times 3.1416 \times R}.$$

there being 60 seconds in one minute, and the circumference of a circle = 3.1416 × 2 × radius. N = r.p.m.

Combining these values, from

$$F = \frac{m}{R} v^2, \text{ we get } F = \frac{W}{gR} \left(\frac{2 \times 3.1416 \times R \times N}{60} \right)^2 = .00034WRN^2,$$

which is a more workable form of the formula for most purposes, and in which

W = weight of the rotating body in pounds.

R = radius of motion.

N = revolutions per minute.

Question.—What would be the total centrifugal force developed in a cast iron flywheel whose outer diameter is 5 ft. 3 in.; thickness of rim, 3 in.; width of face 12 in., and speed 190 r.p.m.?

Answer.—It is usual to consider the rim only in such cases, therefore number of cubic inches of iron in rim = cross section area × mean circumference = (3 × 12) × (5 × 12 × 3.1416).

Weight = 6785.8 × .26 = 1764.32 pounds.

Using formula $F = .00034WRN^2$.

$F = .00034 \times 1764.32 \times 2.5 \times 190 \times 190 = 54,138.16$ pounds, which is the total centrifugal force tending to separate the rim from the hub.

* * *

Question.—If a ten-foot pulley were one pound out of balance, at what speed would it have to be run in order to make the unbalanced centrifugal force equal to a ton?

Answer.—Using the formula $F = .00034WRN^2$, we desire to find N, therefore

$$N^2 = \frac{F}{.00034WR} \text{ or } N = \sqrt{\frac{F}{.00034WR}}$$

Substituting values,

$$N = \sqrt{\frac{2000}{.00034 \times 1 \times 5}} = \sqrt{1176470} =$$

1080 revolutions per minute. That is, at 1,080 r.p.m., the pulley would be a ton out of balance.

* * *

Question.—The Quebec bridge will weigh when completed approximately 65,000 tons. What would you expect it to weigh if the earth ceased to rotate and there was no centrifugal force?

Answer.—Formula, $F = .00034WRN^2$.

W = 65,000 tons = 65,000 × 2,000 lbs.

R = 4,000 miles = 4000 × 5,280 ft.

N = 1 revolution per day =

$$\frac{1}{24 \times 60} \text{ revolutions per minute.}$$

Therefore,

$$F = \frac{.00034 \times 65{,}000 \times 2000 \times 4000 \times 5280}{24 \times 60 \times 24 \times 60} =$$

450,185.3 pounds = 225.1 tons; or, if it were not for this force, the bridge would weigh 65,000 + 225.1 = 65,225.1 tons.

* * *

Question.—The governor weight of an automatic cut-off engine weighs 120 lbs., and its working position is 9 inches from the outside edge of a 4-ft. wheel. The action of the weight is directly resisted by a coiled spring. If the speed be 280 r.p.m., and friction be neglected, what will be the tension of the spring?

Answer.—Formula:

$F = .00034 \times WRN^2$.

$$R = 2 \text{ ft.} - 9 \text{ in.} = 1\tfrac{1}{4} = \frac{5}{4} \text{ feet.}$$

$$\text{or } F = .00034 \times 120 \times \frac{5}{4} \times 280 \times 280$$

= 799.68 pounds.

Question.—If a car weighing 30,000 lbs. went round a curve of 60-ft. radius at the rate of fifteen miles per hour, what would be the force tending to throw the car off the track?

Answer. — The original formula

$$F = \frac{mv^2}{R} \text{ is most convenient in this case.}$$

$$m = \frac{\text{weight}}{\text{force of gravity}} = \frac{30000}{32.16}.$$

$$v = 15 \text{ miles per hour} = \frac{15 \times 5280}{60 \times 60} = 22$$

ft. per sec.

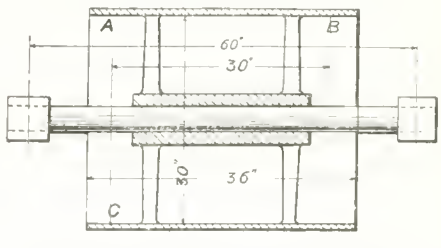
R = 60 ft., therefore,

$$F = \frac{30{,}000}{32.16} \times \frac{22 \times 22}{60} = 7524.8 \text{ pounds,}$$

or 3.76 tons.

* * *

Question.—An idler pulley of 36-in. face and 31-in. diameter, with rim 1-in. thick, is two pounds out of balance on account of a lump at C in the cut. The man who balanced the pulley attempted to correct this by putting a two-pound weight upon the opposite side of the pulley at B, instead of at A as he should have done. Considering the weights 30 in. apart and the bearings 60 in. apart, what would be the force on each bearing due to the wobble of the pulley when running at 1,000 r.p.m.?



PROBLEM IN CENTRIFUGAL FORCE.

Answer.—For one bearing, centrifugal force due to 2 lbs.— $F = .00034\ WRN^2$.

$$W = 2, \quad R = \frac{15}{12} \text{ ft.}, \quad N = 1000.$$

$$F = .00034 \times 2 \times \frac{15}{12} \times 1000 \times 1000 = 850$$

pounds.

This acts at a point 15 in. from the centre of the bearing, and the shaft being pivoted at the other bearing, the force on the bearing would be $\frac{850 \times 45}{60} =$ 637.5 pounds.

Question.—A cast iron pulley has a rim 12 in. wide and 1 in. thick. Its outside diameter is 12 ft. 1 in. Neglecting the effect of the arms, at what speed would it be likely to burst?

Answer.—Formula, $F = .00034\,WRN^2$,

$$\text{or } N = \sqrt{\frac{.00034 \times W \times R}{F}}$$

The force necessary to separate the wheel in halves would be the force necessary to break the rim in two places. This would be twice the sectional area multiplied by the tensile strength of cast iron, and is, therefore,

$2 \times 12 \times 1 \times 15000 = 360{,}000$ pounds, which must be that part of the centrifugal force which acts at right angles to any diameter.

The centrifugal force necessary would

$$\text{be } 360{,}000 \times 2 \times \frac{3.1416}{2} = 360{,}000 \times 2 \times 1.5708$$

$F = 1{,}130{,}976$ pounds.

$1.5708 =$ relation of diameter to ½ circumference.

Volume $= 12 \times 1 \times 3.1416 \times 12 \times 12 = 5428.5$ cub in.

Cast iron weighs .26 pound per cub. in., therefore weight $= 5428.5 \times .26 = 1411.5$ pounds.

$$\text{Now } N^2 = \frac{1130976}{.00034 \times 1411.5 \times 6} = 392700,$$

or

$$N = \sqrt{392700} = 626.6 \text{ r.p.m.}$$

* * *

Question.—In the previous question, if a piece weighing 200 lb. flew off, what would be its kinetic energy?

Answer.—Speed in feet per minute = circumference multiplied by r.p.m.=

$$12 \times 3.1416 \times 626.6 = 23{,}617.8 \text{ ft. per min.} = \frac{23{,}617.8}{60} = 393.63 \text{ ft. per sec.}$$

Formula for kinetic energy is,

energy $= \frac{1}{2}mv^2$, or in other words,

$$\text{energy} = \frac{Wv^2}{2g} \text{ where}$$

$W =$ weight in pounds $= 200$.

$v =$ velocity in ft. per sec. $= 393.63$

$g =$ force of gravity $= 32.16$, or

$$\frac{200 \times 393.63 \times 393.63}{32.16 \times 2} = 481.803 \text{ pounds,}$$

which is the kinetic energy.

BALL TURNING ATTACHMENT FOR DRILL PRESS.

By H. Womersley.

FIG. 1 shows the assembled arrangement of a fixture and tools for turning governor balls in the drill press, and thus relieving the lathe. The most rigid drill in the shop was chosen for the purpose, as freedom from lost motion in the spindle is essential to its success.

The base A is made of cast iron to which the brackets B and C are fitted, the former supporting the worm D upon

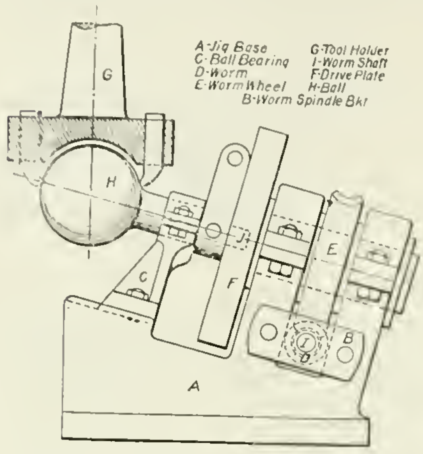


FIG. 1.—BALL TURNING FIXTURE.

the spindle I. A worm gear E is driven by worm D. The bracket C should support the work as close up as possible without interfering with the operation of the cutters. This bracket is also equipped with different bushings to accommodate ball shanks of various sizes. A small clamp fastens the ball to the driving plate F and the work is centred by the small projection J which is cut off when the job is finished.

The work is shown at T, Fig. 2, and the tool holder at S in the same figure. It is easily seen that, as the ball is revolved by means of a ratchet wheel or other means, attached to the worm

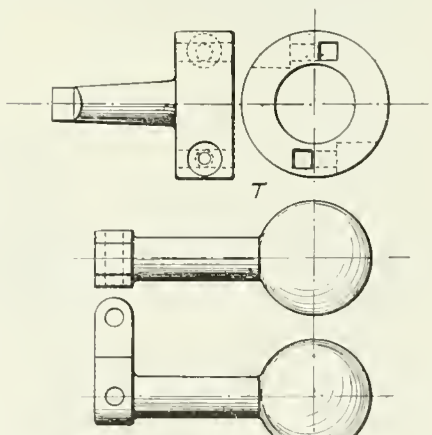


FIG. 2.—WORK AND TOOL.

spindle, the cutters will reach every part of it and the result will be a true sphere. The balls are first centred in a small lathe and the parts J and the shanks are turned by an apprentice. They are then taken to the drill where the balls are turned. The finishing touches are put on in the speed lathe where the work is polished.

A MEANS TO AN END.

By Armley Leeds.

UPON assuming the management of a machine shop engaged in a large general business, I was particularly struck with the inconsistencies in the times allowed for certain pieces of work. The bonus system as it was employed was not fully satisfactory, but I came to the conclusion that its chief weakness lay in the wrong adjustment of time allowances. The times apportioned by my predecessor to machining the different parts of governors seemed particularly unreasonable to me, but that allotted for turning the balls went to the limit in this respect, so I decided to begin here with my reforms. The trades union element in the plant was strong and seemed to devote itself to maintaining the time allowances as large as possible, which made any readjustment particularly difficult.

The turning was being done in a radial feed motion arrangement attached to the gantry and could be applied to only one lathe. I approached the turner and pointed out to him that the job was taking too much time, basing my assertion upon the available cutting speeds and feeds of the machine and tools. He replied that he was perfectly willing to let any other lathe man in the shop have a try as he was confident that the time could not be reduced. This was of course impossible, for the other men knowing the actual and allowed times would see that these were not lowered. I therefore proposed that I should do a few myself and that my speed should set the pace for the job. This he would, on no account, agree to.

I was determined to gain the point, however, so I arranged for a little competition by constructing an arrangement to do the work on the drilling machine. This plan proved most successful. After turning a few in this way, the job was put back temporarily on the lathe with the result that the turning time came down from 52 to 32 hours. It has also added considerable flexibility to the job by making it applicable to either of two machines that happens to be idle, the advantage of which, every foreman knows.

I have read a great many articles and books dealing with scientific management, but I still find that a little judicious competition will solve many problems still unraveled by the advocates of these systems.

When starting up a boiler that has been dead, raise steam slowly, drop the pressure a few pounds on remaining boilers in the battery, and do not open the stop valve until the gauge on the dead boiler shows the same pressure as the other boilers.

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

CONVEYING MOLTEN METAL.

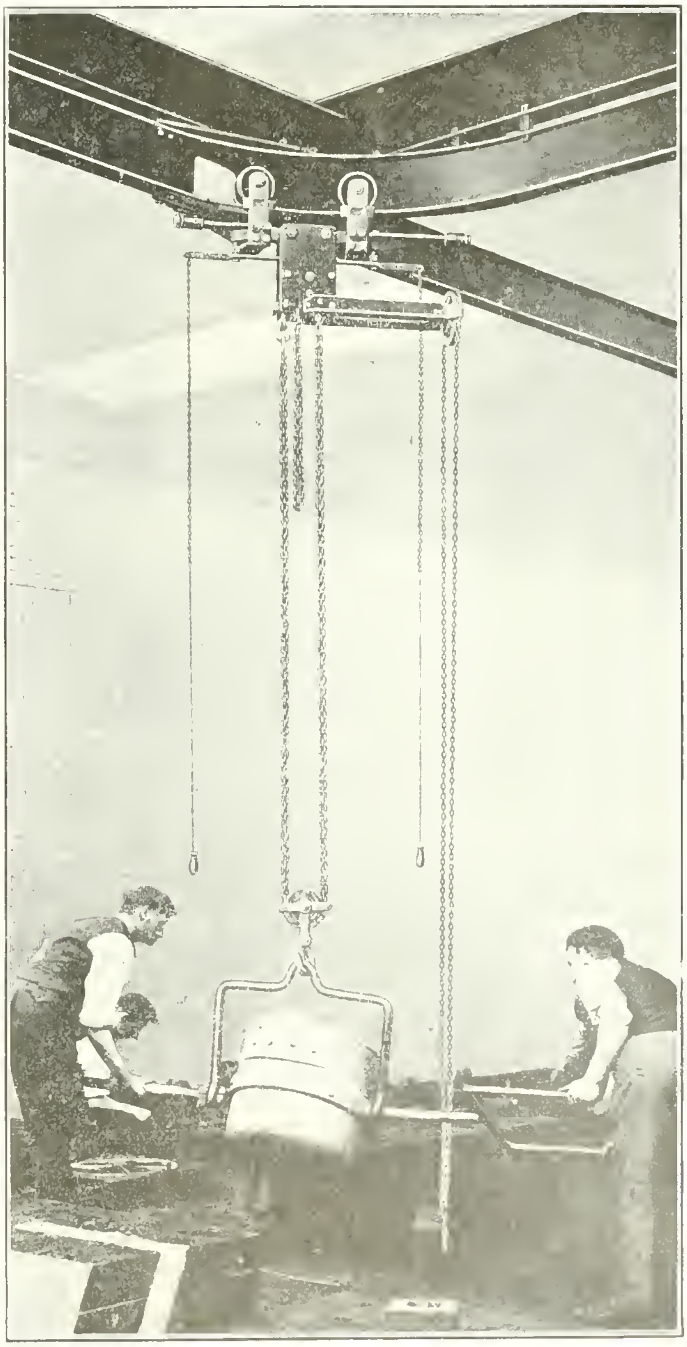
THE constant grind of competition is gradually but surely eliminating from the foundry many of the methods that were considered good enough by our forefathers, and this applies particularly to the ways and means for moving materials and equipment from point to point as required. Pig iron, coke, and sand have to be brought in, patterns, cores, and flasks have to be taken to their appointed places, and, most important of all, the hot metal has to be carried to the moulds, and, finally, the castings have to be removed to the cleaning shed.

When foundries were small and compact, a good old-fashioned timber-frame jib crane was all-sufficient for distributing molten metal from the cupola to the moulds grouped conveniently around it, but as the use of cast-iron grew, the size of the foundry floor was necessarily increased, and the jib crane as a means of transportation was displaced by a hand or electrically operated overhead traveling crane, which covers the whole area of the moulding bed. However, even the overhead traveling crane has its limitations. The best and most modern electric cranes can only handle one full ladle at a time, and it must return each time to the cupola to replenish, thus forcing the men to wait their turn for the metal. This is frequently a source of confusion as well as a waste of time and material.

The overhead track was next evolved to enable each man to serve himself. The track at first consisted of a simple flat steel bar, with a little trolley running on the top, and crude switches were fastened to connect up the sections of track and allow the trolleys to run all over the system; but the combination of rough-and-ready construction with foreign, uneducated help, resulted in frequent and in some cases fatal accidents, which inevitably cast discredit on the whole principle of overhead tracks.

Our illustration depicts the Morris Q.E.F. Junction, the feature of which is that it has no moving parts. It is always "set," no matter in which direction the trolley is required to run. The switch has no "open ends" from which it is possible for a headstrong man to run off a trolley carrying a ton of molten metal, in spite of carefully devised "automatic stops."

The steering gear of the Morris trolley being on the trolley itself, the operator is thus able to determine the direction which the latter will take long before he arrives at the switch, and, iron at a quick run, so that the metal may be carried if necessary a couple of hundred yards from the cupola and still arrive at the mould in good condition for pouring.



CONVEYING MOLTEN METAL.

what is even more important, without even retarding the motion of the trolley in order to take the turn. Each trolley possesses eight dust-proof ball bearings, and will carry a big bull-ladle full of

Another interesting feature of the Morris traveling chain-block is clearly shown in the half-tone. The operating chain of the lifting gear is extended to one side, so as to fall quite clear of the

ladle, thus keeping cool for the users' hands, and preventing that sudden disappearance which inevitably follows when a pure iron chain is dipped into molten metal.

The Canadian Westinghouse Co., Hamilton, Ont., is at present installing a runway on this principle, of $1\frac{1}{2}$ tons capacity, and we hope before long to be able to put before our readers some particulars of this installation.

COMBINATION HAND DRILL AND SENSITIVE DRILLING STAND.

WE herewith illustrate a new machine recently brought out by the Cincinnati Electrical Tool Co., Cincinnati, Ohio. It is a combination of their portable electric hand drill and a sensitive drilling stand. The hand drill can be used independently of the stand or as a sensitive bench drill, giving two tools in one. The hand drill is inserted or detached in a few seconds by means of the thumb nuts releasing the hinged caps, which lock it in the bracket.

The bracket has a 3-in. feed on the column, with quick return, and is operated by the hand lever. It has a vertical adjustment through the clamping screws on the column, and can be set at any desired point. A stop on the column regulates the depth of the holes to be drilled. When not required, the table, which is 8 inches in diameter, can be turned aside. The drilling stand is made for drills of $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ in., and weighs 60 lbs. The column is 30 in. high and the distance from it to the centre of the table is 5 inches.

This combination will be found particularly useful for shops where both outside drilling and bench drilling is

COMBINATION HAND DRILL AND SENSITIVE DRILLING STAND.

to be done, and where one of these two classes of work is only occasionally done. The machine can be set anywhere and is built in its entirety by the Cincinnati Electrical Tool Co.

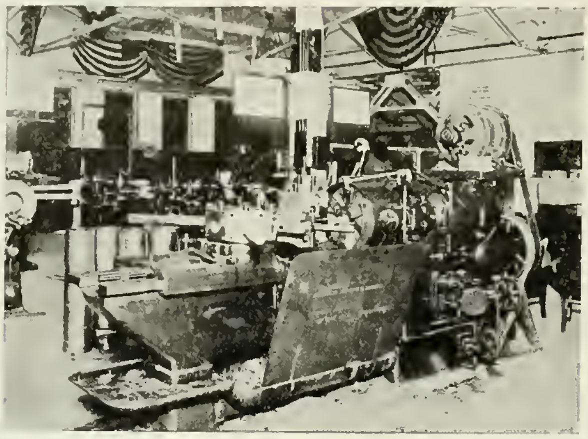
ONE HOUR'S LATHE WORK IN 7½ MINUTES.

THE lathe shown in the illustration was exhibited at the Foundry and Machine Exposition at Chicago last October, and, while there, was shown working on dropped forged gear blanks, $8\frac{1}{2}$ inches in diameter. The following results were obtained many times:—

Rough and finish boring, $5\frac{1}{2}$ minutes.

Rough and finish turning, and facing on rim and hub, 2 minutes.

Total time, $7\frac{1}{2}$ minutes for a job that is generally admitted to be a good hour's work for an engine lathe.



ONE HOUR'S LATHE WORK IN 7½ MINUTES.

This lathe is an 18-inch Libbey turret lathe manufactured by the International Machine Tool Co., Indianapolis, Ind. Its makers claim that its rapid production is due to the great power developed, the strength and stiffness of all parts, and the convenience of operation. The entire control of the machine is concentrated for the operator, and is so designed that the actual manual labor required of him is reduced to a minimum; he is, therefore, offered every inducement to push the machine to its capacity.

It is driven by a Westinghouse Electric alternating-current constant speed motor. The speed changes are effected through a sliding pinion and two double frictions are so arranged that the operator can stop his machine in the midst of a heavy cut and pick it up instantly under feed. Eight steps are provided, giving speeds ranging from 8 to 300 r.p.m.

Y. M. C. A. AIMS TO LESSEN NUMBER OF MISFITS.

A NEW feature of special importance in the organization of the Vocational Department has just been added to the work of the Central branch of the Toronto Young Men's Christian Association. The function of the Vocational Department is to assist boys in the choice of their life work, and is headed by an exceptionally strong executive committee and an advisory council of more than a hundred prominent business and professional men. The project has been unanimously indorsed by the Board of Education, which has placed at the disposal of the committee any assistance which can be given by the principals of the schools and other members of the staff to aid the carrying on of the work.

In organizing the department, the officials were actuated by the knowledge that so many boys, after their school days, are thrown upon their own resources. Without proper guidance many drift into work for which they are not fitted, thus lessening their chances of success. With the assistance of the advisory councillors, the Y. M. C. A. proposes to lessen the number of misfits.

Clearing-House for Boys.

The association will also undertake to have addresses given from time to time to groups of boys desiring to enter certain spheres of business, such addresses being given by men prominent in their particular lines. It will also assume the nature of a clearing-house for boys leaving school, and will be of material assistance to manufacturers and business men by placing the right kind of boys in their hands. The department will deal not only with boys leaving school, but also with older boys who are already at work, and also with young men attending the university.

The executive committee is as follows: Chairman, Dr. Jas. L. Hughes; W. P. Gundy, President Board of Trade; Dr. Fred. J. Conboy, Board of Education; Controller James Simpsin, Secretary and Manager Labor Temple Co., Limited; John A. Tory, Supervisor Sun Life Insurance Co.; Dr. A. H. Abbott, University of Toronto; G. A. Warburton, General Secretary Y. M. C. A.; J. P. Hagerman, Boy's Secretary Y. M. C. A.; Department Secretary, E. F. Trimble.

Efficiency of the Individual

By GEO. H. SHEPARD

Illustrated by A. LISMER

AN Englishman once said that the American business man leads a life of intense activity. He rushes to his office, after a hasty breakfast, reading the morning newspaper at the table or in the car, for lack of time to read it otherwise. He opens his mail, reads it hurriedly, and dictates the replies. He snatches a quick lunch in ten or fifteen minutes or goes hungry. He posts off to another part of town, attends a business meeting or two, meets representatives of several other concerns, hurries back to his office, reads and signs his mail, and hurries away to an evening meeting. Said the Englishman, "He has not been idle fifteen minutes all day, and he has not thought fifteen minutes about anything."

Such strenuous, intense, driven lives fill early graves and recruit the mad-houses, while they show little in the way of achievement in comparison to their enormous outlay of energy.

In exceptional cases men of unusual endurance drive themselves like steam engines and attain wonderful success; but there are at least well known instances where men of that type, in the physical slump that comes to men in later middle life, have gone down completely.

For the hurried, driven, and overworked there is relief

The effects of the application of the principles of efficiency in industry are well known. As a general average based on American practice, the possible results may be roughly stated as a thirty per cent. reduction of unit costs, excluding materials.

These economies are the sum of detail results throughout the business, of savings of the time of this worker, of the labor of that one, of reduction of waste of material on this article, of economy of power on that machine, of reduction of idle capital here, of effective use of waste room there.

These economies of time, labor, and money in a business are, after all, obtained only as the sum of such results in the cases of many of the persons in its service.

It is proposed, in these articles, to apply the lessons of industry for the benefit of individuals.

Results are obtained by the application of a few definite principles, as follows:

Ideals; personnel, scientifically selected and organized; higher common sense; discipline; fair deal; standards; conditions and work adapted to each other; doing things the best way; instruction; planning; despatching; immediate, adequate, and reliable records; efficiency reward.

I should advise any one who wants to increase his personal efficiency to begin by memorizing thoroughly the above list of principles. They should be learned so thoroughly that they become subconscious, that is, so that it becomes second nature to apply them without conscious thought, just as one walks without any attention to what his legs are doing.

The rest of this series will be devoted to an explanation of every principle in turn in its application to the individual. As the meaning of a principle becomes plain, it should be put into personal application. As soon as a violation of a principle is recognized, it should be corrected. By so doing the application of the principles will become habitual and subconscious.

IDEALS.

It is desirable to set forth some ideal which will be universally accepted.

The most civilized philosopher, the most ignorant savage; the ascetic religious devotee, the gay votary of pleasure; the busy man of affairs, the dawdling idler; the gentlest woman, the most hardened criminal; all have one ideal in common. Each in his own way and according to his own light, desires and seeks happiness.

I would, therefore, set forth happiness as the supreme and all-inclusive ideal for the individual.

We are so made that we find happiness permanently only in altruistic service. This is a law of nature against which we rebel, but to whose obedience we are driven back by those severe penalties which nature visits upon all violations of her laws.

Let a man adopt any egoistic ideal and his efficiency, though it may be great in quantity, becomes negative in sign.

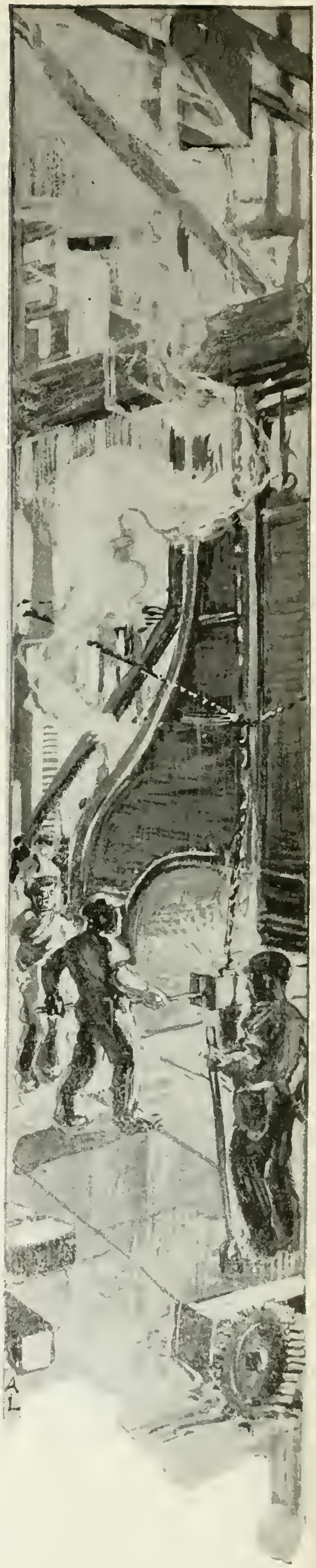
Like the ancient Hebrew king who gathered silver and gold and all delights, so that he was great and increased more than all that were before him, but who gave himself successively to the ideals of pleasure, of greatness, of wealth, and finally even of wisdom; for him shall be the cry:

"Vanity of vanities, all is vanity. What profit hath a man of all his labor which he taketh under the sun? . . . . Therefore I hated life; because the work that is wrought under the sun is grievous unto me; for all is vanity and vexation of spirit."

Most happily, in late adolescence develop both the altruistic feelings and the attraction between the sexes. The natural result of the latter is marriage and family life and cares, in which one's altruism finds immediate and stimulating exercise, and in which most of us find the only real happiness that we ever know.

The happy result of the altruism into which nature, before we realize what she is about, thus forces us, sets forth as a corollary to the proposition that happiness is our supreme ideal, that the immediate secondary ideal is altruistic service, even though one's circumstances may limit his practical application of that ideal to the support of his own family.

The ideal of service includes all other right ethical ideals. "Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind. This is the first and great commandment. And the second is like unto it. Thou shalt love thy



neighbor as thyself. On these two commandments hang all the law and the prophets."

As a principle of efficiency, a secondary meaning of the ideal is a definite purpose which must be pursued resolutely, courageously, and without hesitation or vacillation.

The man without a purpose is a drifting derelict, useless to himself and a menace to others. The man who resolutely follows a set purpose is the ship with the strong hand on the tiller and the eye of the helmsman on the compass.

In all history there is hardly a more pathetic figure than Columbus, dominated by his ideal of sailing westward to India, going from court to court seeking a backer for his enterprise, for years meeting only discouragement and rebuffs, but always pursuing his ideal. What a reward was his when, first of all the watching companies of his three ships, he at night saw lights ahead on the shores of the New World, and felt that his ideal has been attained! Nor was the world wholly ungrateful. To-day, sainted by the Roman church, the first of a ducal family, honored annually by a great republic, the name of Columbus is a monument to the fact that even one's fellow-men give their rewards to the man who chooses a noble ideal and unswervingly pursues it.

In even the smallest detail of one's work, the first requisite is a clear idea of what is to be accomplished and then a concentration of effort upon it.

Lack of purpose is the cause of innumerable failures. The ordinary man goes to work at the end of his school days with no idea of the kind of life for which he is fitted and with no definite ideal beyond the weekly pay envelope. Work assigned to him by his superiors he does indifferently because he sees beyond it no inspiring ideal. He is through life an opportunist and a failure.

If any course of action is itself incorrect, the determined pursuit of it is mere obstinacy, and is certain to lead to failure.

This illustrates the general truth that the application of any one of the principles of efficiency may be abused into a vice.

DEVELOPMENTS IN COMMERCIAL MOTOR VEHICLES.

By Thomas Clarkson, M.Inst.C.E.

In a paper read recently before the Institution of Civil Engineers, of which what follows is an abstract, the author said that during the period which has elapsed since the subject of motor-vehicles was last reviewed before the Institution, remarkable developments have taken place in this department of engineering, both in regard to the quality of the vehicles, and in the magnitude of their operations for the transport of passengers and merchandise.

Greater facilities for the transport of passengers in cities are constantly in demand. Electric rail-motors, both on the surface and underground, have met this demand to some extent; but the motor-bus has demonstrated its superiority over the rail-car or tram.

Complete flexibility is obviously impossible in motors dependent upon an extraneous power station; the vehicles must be self-contained, and the power generated from within. The author regards flexibility as the key to the successful solution of the street traffic problem in cities.

Power Generation Feature.

There are at present three methods of generating power for commercial motor transport; namely, by internal-combustion engines, by steam engines, and by electric motors. Each of these methods has found a fairly clearly-defined field of utility. The internal-combustion motor far outnumbers the other types of motor for net loads up to 3 tons, but for heavier duty than this, the steam-motor continues to hold the field.

The rise in the price of petrol has directed attention to other liquid fuels for the internal-combustion motor, and the steam-motor using solid fuel is being adapted for loads less than 3 tons, with the object of checking the ever-growing demand for motor spirit. The electric vehicle supplied with energy by a storage battery has made remarkably little progress.

Fuel.

The petrol motor is confined to the employment of a volatile liquid fuel, while the steam motor may use either liquid or solid fuels. The relative cost of the two systems for fuel per mile is, of course, governed by the ratio between the cost per pound of fuel and the mileage per pound.

The fuel cost for a 3-ton petrol commercial vehicle, with petrol at 32 cents per gallon, and at 8 miles per gallon, works out at 4 cents per car mile. The London petrol bus, which may be taken as equivalent to the 3-ton commercial vehicle, costs about 2 cents per car mile for fuel. This lower fuel cost, it should be explained, is not due to superior engine efficiency, but is the result of an exceptionally favorable contract for the purchase of petrol in very large quantities. The present cost of fuel for London petrol buses is, therefore, abnormal from the point of view of the ordinary user of petrol commercial vehicles.

The steam omnibus at present costs for liquid fuel 3¾ cents per mile, which is a little less than the cost of the ordinary petrol 3-ton vehicle, while the steam omnibus, or 3-ton lorry, using coke, costs for fuel one cent per mile, with coke at $4.60 per long ton.

The significance of this economy, and the real value of an apparently small reduction in cost per mile, is indicated by the fact that a cent per mile represents, approximately, $972,000 per annum on the cost of running London omnibuses.

With regard to the relative reliability of petrol and steam cars, it has been demonstrated conclusively that, with either type of motor, the mileage lost from mechanical causes is extremely small, even when performing a commercial duty involving an annual mileage of 30,000 miles and more per vehicle.

Cost of Upkeep.

As regards the cost of mechanical upkeep, there does not appear to be any reason for a material difference between the two systems under this heading when they are run under similar conditions of management. The light steam 3-ton vehicle using coke as fuel may be regarded as combining the speed and handiness of the petrol motor, with a fuel cost equivalent to petrol at 8 cents per gallon.

The paper gave details of the construction of present types of both steam and petrol omnibuses, and dealt particularly with modern methods of omnibus illumination, while the important question of the construction of road wheels, most suitable for commercial motors of from 30 cwt. to 3 tons' capacity, was also dealt with.

The present position of the electric commercial vehicle was considered in relation to other types of motor, particularly with reference to the investigations of working costs which have been recently conducted by the Massachusetts Institute of Technology, and concluded with a reference to modern steam motor-wagons and tractors.

GREATER EFFICIENCY IN FACTORY AND OFFICE.

That greater efficiency in all departments of manufacturing and mercantile organizations is being sought after more than ever before is evinced by the fact that an executives club has been organized in Detroit, one of the greatest manufacturing centres in the United States, for the purpose of determining how the efficiency of Detroit organizations can be materially increased.

The instigator of this worthy movement is Mr. E. St. Elmo Lewis, one of the big men connected with the Burroughs Adding Machine Co. In all of Mr. Lewis's speeches and in all the books he has written on a great variety of subjects, he drives home the urgent need for greater efficiency in factory,

store, and office. He is perhaps the best informed man on the question of efficiency in the United States. His book, "The New Gospel of Efficiency," is looked upon by officials of large corporations and business men in general as one of the best ever written on the subject of efficiency; therefore, with such a man as president, the Executives Club is destined to become a powerful and useful organization.

The club is at present in its formative stage, but ultimately it will be composed of fifty members of as many different organizations in Detroit. It is not an organization which anyone can join on their own initiative. Only those men are invited to join who are of the kind that will bring something of value to the organization, and who will devote thought and time to the propaganda. There are no regular dues, each member being assessed a proportionate amount to cover the budget.

Club Objects.

The primary object of the club is to study efficiency, scientific management, welfare work, methods of employment, etc., and one subject at a time will be taken up. Exhaustive researches will be made in factories, not only in Detroit, but in other cities of the United States and Canada. Theories will not be accepted. The members will seek for cold, hard facts, and in their search for information they will employ a paid investigator. This man will be under instructions to gather his data from real experiences in any branch of the work he investigates.

Plans are now being made for a series of twelve or fifteen lectures to be given this fall on different efficiencies, such as those in the sales department, production, management, office, etc. In each case where a lecture is to be given the men interested in that lecture, who are employed by the members, will be invited to attend at the expense of the firm represented in the Executives Club.

An efficiency propaganda cannot be carried on successfully by any one firm or individual, nor by any club. The study of efficient methods and management must be carried further. Managers of plants must know about successful methods used in all plants. It is the purpose of the Executive Club to find out how other people "are doing it." The factories and commercial houses directly represented will not be the only ones benefited, for the results of the researches and study will be given to the business world at large through the medium of the leading technical journals.

KNOWING A GOOD EMPLOYEE.

ALMOST everybody at some time becomes an employer of the brain and muscle of other men and women. It may be only a few odd jobs about the house you want done, or it may be a high-salaried private secretaryship you want filled, but whatever the position, you naturally want to find a man or woman who is best fitted for it and who will do that particular work with the greatest efficiency.

How are you going to decide who that person is? Too many employers have tried to solve the problem by "rule of thumb," relying upon some mysterious instinct to show who "would do" or who "would not do." The business world is now beginning to realize, however, that men and women hired in this haphazard way are apt to prove costly experiments.

The selection of just the right men and women for certain kinds of work is fast being reduced to a more or less exact science. Professor Munsterberg, the psychologist, has devised various mechanical tests for determining which of several brains is the most efficient, and physicians are evolving ways of measuring a human being's physical efficiency more accurately than was ever before possible.

Selection Features.

Miss Kathleen Blackford, one of the new employment experts, believes that personal appearance can do much to decide anybody's fitness or unfitness for a certain task. Thus, a light-complexioned person, or a pale blue-eyed individual usually is apt to be more masterful and more capable than a dark-eyed, black-haired, brown-fleshed one. The latter has less mastery that the light one, just as the African races are more contented and docile than the white.

Size, next to color, is a most vital matter as far as indicating efficiency is concerned. Scientific management of the new sort, which reduces labor, time and expense, and economizes every little movement, requires that men and women not over five feet six inches in height should be engaged for work which requires much bending over counters, reaching under shelves, or sitting for a long time in one position.

Workers over this height and up to five feet two inches must never be hired as bookkeepers, bank clerks, or for labor at machines or in positions which make them perform excessive movements. Every ungraceful, awkward bend they make reduces their efficiency and earning power.

Real Ability.

Gait, movement, attitude and posture all play important parts in selecting an employee. A shuffling, shambling walk, dragging and scraping of the feet, means timidity and slavishness. Overbold posing means impudence and effrontery. Real ability and power are evidenced by matter-of-fact, symmetrical and unconscious stride.

Shaking hands as well as the appearance of the hands and the quality of the finger nails all points to the presence or absence of skill. A firm, unconscious handshake with a sound grip which lingers neither too long nor drops the other hand too quickly, is a sign of health, vigor and sincerity.

A flabby shake spells hypocrisy, dishonesty and indifference. It is almost certain proof of inattentiveness and unreliability. Pale finger nails with little picks and tears of the badly-trimmed nail, as well as the presence of long nails, mean nervousness, poor health, slovenliness and the thraldom of bad habits. Any one who bites his nails is one easily muzzled into routine. Wise employers are cautious about hiring nail-biters, as they are apt to get into a hopeless rut.

Long, over-polished, manicured nails usually accompany an extravagant, lazy, over-indulged disposition, while short, clean and smooth nails, which show no evidence of the manicure's work, mean soundness of body and mind and a high degree of intelligence.

Texture and quality of the flesh of the hands and face also shed side lights upon an individual's qualifications for duty. A burrowed brow with sunken flesh around the sockets of the eyes, hollow cheek bones and a flabby skin mean narrowness, bitterness and lack of power to put the full measure of work in an appointed task. If the skin be fine and filmy, and of a smooth spun type, pale and inclined to be dark, the individual is too dreamy and too aesthetic to keep his mind on his task.

Flesh that is taut and smooth, without the earmarks of coddling or the sallowness and pallor of health not exactly at par, is usually a good sign of capacity and endurance. Reddish cheeks and dancing eyes make a man particularly desirable for positions where strangers must be met for the first time.

Miss Blackford has a long list of questions designed to bring to light facts which an inspection of the candidate fails to reveal. Through these skilfully arranged questions those who pretend to frankness and modesty show in their answers that they lack certain accomplishments which are easily discovered. The most dynamic and best endowed workers, it has been found, answer all questions without modesty, without boastfulness and precisely according to the truth.

WHY DO GRINDING WHEELS "FILL" OR "GLAZE?"

By Oscar A. Knight.

I HAVE found with cylindrical grinding that wheels sometimes fill and then glaze. I have also found that wheels sometimes glaze without filling.

Filling of a wheel, commonly called loading, is when small chips adhere to its face. When this condition exists, the clearance places between the cutting particles become filled and prevent the wheel from cutting freely. When a wheel becomes partly filled, and the operator continues to use it in this condition, the few remaining uncovered cutting particles glaze, and he believes the wheel is too hard.

It has been my experience that filling takes place only with soft and tough material, such as brass, bronze and steel, both soft and heat treated. I can recall no difficulty from filling with hardened steel or cast iron.

Causes of "Filling."

Filling may be caused by the wheel running at a speed either very much or a very little too slow. Speed should be from 6,000 to 6,500 surface feet per minute. Filling may also be caused by crowding a hard wheel to a greater depth of cut than the size of the projecting grains, and, revolving at a slow speed with plenty of power, the grains would withstand this crowding without breaking away, and thus "pick-up," as the operators say.

There is one plant where there are eight 6 x 32 in. machines in one department in line with each other. The "Safety First" superintendent obliged the foreman to reduce the wheel speed. The speed of a 14-in. diameter wheel on a 6 x 32 in. Norton machine should be 1,760 r.p.m. The safety superintendent dropped this speed to 1,450 r.p.m. A week later I called, and the foreman asked why he could not finish with the eight machines as he once did. He said he could grind only twenty pieces between truings. With a speed indicator I found his wheel was running about 5,250 periphery feet per minute. We found the old pulleys and brought up the wheel speed. His operator then ground four hundred pieces between truings.

In connection with this subject I will report the action of a wheel which was used in an automobile factory this last month. A 10 in. x 50 in. Norton plain machine was equipped with a 20 in. x 5¼ in. x 12 in., 38, 24 L wheel, grinding vanadium steel shafts 1 in. diameter, and removing .035 in. to limit of .001 in. The shafts were 53 in. long, and their ends were ground 5⅛ in. long. One hundred and eighty-six of these ends were ground in four hours. This time included truing the wheel twice throughout the four hours. One truing lasted for one hundred pieces.

The total wear of wheel on one hundred and eighty-six shafts was .020 in. on diameter, and there being 4¼ in. of wear on each wheel, this means that approximately 40,000 pieces can be ground with one wheel. There was absolutely no filling or glazing. The shafts were inspected by the inspector foreman and pronounced the best work he had seen since he took charge of this department.

Glazing and Its Causes.

Glazed wheels caused by a hard bond of a wheel have become dulled or worn down even with the bond, the bond being so hard as not to have worn away between the cutting particles to give clearance, and thus preventing the cutting particles, when dulled, from breaking away, and allowing new particles to do the work. Glazing is caused by too hard a wheel or too fast a speed or both.

Glazed wheel caused by a hard bond result in spindle boxes wearing out of true and out of line, excessive wear of workshoes, mottles, chatter marks, feed lines, inability to duplicate sizes, loss of production, and a waste of power.

Two-thirds of my visits to instruct operators are to teach them how to use their wheel in order to obtain the greatest production with the least wheel cost, and at the same time produce accurate work. This is rather difficult because the right wheels for certain work in one shop are too soft or too hard to be of use on the same work in another shop.

Piston pins in one automobile factory are finish ground on a 6 in. x 32 in. Norton machine with a 24 O wheel at the rate of 800 per day. In another factory these same pins are ground with a 24 K, 600 per day. Both customers are satisfied with the wheels they are using. The first customer could not use a K wheel, while the second customer could not use an O wheel; and no one can convince the first customer that he should use a K wheel, or any other wheel but a 24 O.

Miscellaneous Features.

What is the difference between glazing and filling?

Filling takes place when wheels are too hard and revolve at too slow a speed, while glazing takes place when wheels are too hard and revolve at too fast a speed.

What are some of the indications that a wheel in use is hard?

If the machine require great power to run it (greater than recommended by its maker), the machine, in all probability, is using too hard a wheel. Other indications are: the necessity for frequent adjustment of wheel spindle boxes; the surface produced may have feed lines, chatter marks, or is of a bluish gray surface when it should be a light gray; automatic cross feed refusing to duplicate sizes quickly, requiring a long time for the cut to disappear after the wheel feed index shows that the work is at the proper diameter; requiring frequent dressing.

If the grinding wheel appear hard, and another wheel cannot be obtained, how can the wheel be better adapted to the work, and why?

If the speed of a hard wheel be too fast, I should first cut it down to its proper surface speed. I should also use a sharper diamond to dress the wheel, because a sharp diamond leaves the surface with more clearance, and the surface would cut like a softer wheel for a greater length of time. I should also increase the surface speed of work, because by increasing the surface speed of work, the grain depth of cut will be increased, and the glazing surface caused by hard bond will wear away, and the surface act like a softer wheel.

If the wheel appear soft, so that it wear away rapidly, what change would you make in the work speed to improve the working of the wheel?

Speed Changes Due to Wheel Wear.

In connection with this subject, I will relate an experience of two years ago. A customer was using a 10 in. x 50 in. Norton machine, grinding work placed on arbors. These pieces were 3¾-in. diameter, by 1⅛-in. face, and ten were ground at one time on the arbors. Using a 3860 L, 18-in. x 2-in. x 5-in. wheel, our machine produced 690 pieces in 9½ hours. As the wheel wore away, the production dropped less and less, until when the wheel was 15-in. diameter, the production was only 600 pieces in 9½ hours. The speed of work, with an 18-in. diameter wheel, was 75 feet per minute. When the wheel wore to 15-in. diameter, with this same 75 feet per minute of work speed, the wheel appeared softer; but in reality it was no softer than it had been at 18-in. diameter.

By decreasing the work speed to 50 feet per minute, and increasing the depth of cut .00050 in., we overcome the difficulty and proved that the wheel was the same grade at 15-in. diameter as it was at 18-in. diameter, and the operator's production the next day, with the same wheel, was 950 pieces.

Thus it is seen that by decreasing the work speed, thus diminishing the grain depth of cut and increasing the radial depth of cut, the production was carried up from 600 pieces to 950 pieces per day without undue wear on the wheel.

All leaks in pipes, flanges and gaskets should be repaired at the earliest possible moment, as they may be caused by defective material.

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Vol. XI. MAY 7, 1914 No. 19

PRINCIPAL CONTENTS.

SYSTEM OF PROMOTION.

IN most plants, particularly those not operated upon a piece-work basis, incentives are necessary to make it worth while for a workman to give his best mind and energy to furthering his employer's interests. One of the very best, most elevating and often neglected forms of encouragement is the assurance of continuous promotion founded upon merit. There is no reason why there cannot be as many promotions as there are benches or machines in the shop. Each position should in any case be accounted a step in advance of some other, and the top situations should have decided advantages. The starting of a new man or apprentice at the bottom need not necessitate a stepping up all along the line. Some are lost, so to speak, on the way up, and enough step-overs can be permitted in cases of marked inefficiency to keep the danger of this indignity ever before the men.

The advantages of such a system honestly and fairly carried out are obvious. An incentive of a high order both for good character and good work is continually in operation; discipline is much more easily maintained; a junior knowing his plan of education can anticipate it and can master it in advance with the help of his immediate seniors in position; the work for which men are best fitted can easily be determined and, above all, a most useful class of mechanics will be produced.

TAXING INDUSTRY.

ONE of the modern excrescences which has gained a foothold on the back of industry is the fad of system. An American magazine which devotes its pages to the gratification of those who take the same delight and satisfaction out of rearranging the management of businesses that a chess player does out of his game makes an appeal for the establishment of a bureau by the Government for the purpose of disseminating knowledge respecting business practice. This is quite in line with the modern tendency to heap on the shoulders of the taxpayer still further burdens. Hitherto the world has progressed as the result of the initiative of the individual—initiative developed by the stress of experience, and the absence of debilitating paternalism. The development of business efficiency and modern methods is the result of hard experience, not of fantastic theorising, nor of government succour. The old school is still adequate. To the establishment of new Government departments agriculturalists of the United States are raising a protest.

Mr. James E. Poole, a well-known cattle man and an authority on cattle markets say that "the tax gatherer and the assessor are working hand in hand and doing night and day stunts with the result that taxation has reached such exorbitant limits that there is likely to be a still greater trek to Canada in the immediate future." Mr. Poole points out that in one county of Indiana, 90 road inspectors have recently been appointed at a per diem of $5, and the farmer pays the toll. Similar protest has been provoked by increase in tax bills in Illinois, Iowa and other states. Due in a large measure to multiplication of officers for political machine building purposes, taxing agriculture to the limit promises to be a questionable policy.

During recent years, the tendency in Canada has been to multiply Government departments which add very largely to the pay roll to be met by taxes upon the workers of the country. By taxing financial corporations legislators are taxing the farmers. The latter think that the burden is not on their shoulders when the tax is specifically placed on premium incomes, bank capital and other revenues of corporations. In this they are absolutely mistaken. All forms of taxation falls upon the back of the actual wealth producer. The lighter the burden of taxation the more buoyant will be the productive energy of the country. There is great need of public economy and the elimination of unnecessary officialism. There are too many men in receipt of public money who know how to do things or make a profession of being in a position to discover better methods than those existing, and too few men who actually do things and make the best of existing machinery and methods.

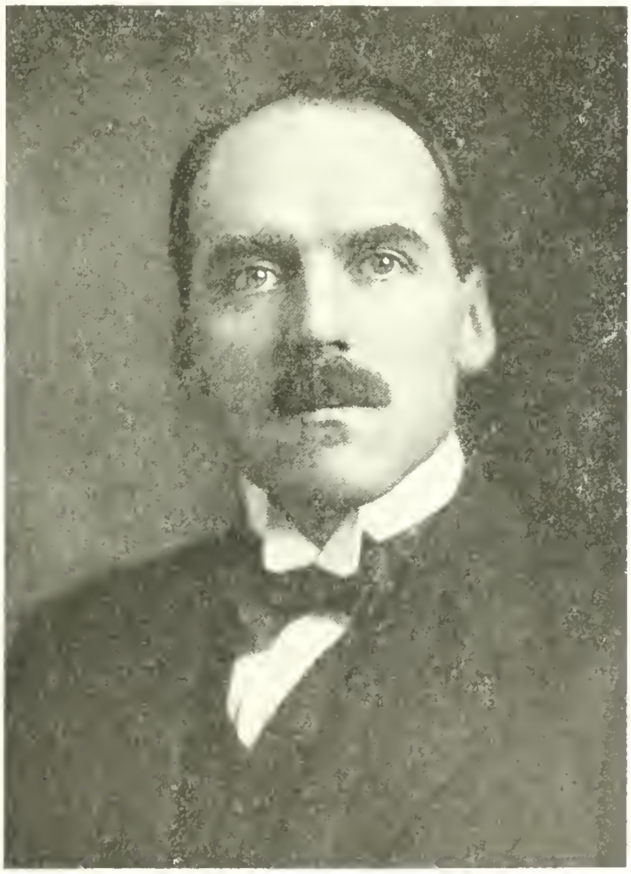
INDUSTRIAL NOTABILITIES--No. 33

JOHN KENNETH LEVESON ROSS was born at Lindsay, Ont., in 1876, a son of the late James Ross, C.E., Bank of Montreal and C.P.R. director, etc.

He was educated at Bishops' College, Lennoxville, and at McGill University, Montreal, from the latter of which he graduated as a B.A.Sc. in 1897.

J. K. L. Ross acquired his business training under his father through official connection with several of the latter's enterprises, which embraced the City of Birmingham Tramways Co.; the Central London Railway; the Dominion Coal Co., and the West Indian Electric Co.

Rated a millionaire, he is a director, the Dominion Bridge Co.; director, the Lake of the Woods Milling Co.; director, the Canadian General Electric Co.; director, the



JOHN KENNETH LEVESON ROSS.

Laurentide Co.; director, St. John Railway; a governor of the Royal Victoria Hospital, and of McGill University, both of Montreal. He is also an officer of the 5th Royal Highlanders of Canada.

Mr. Ross is a member of the following clubs:—Mount Royal; St. James; Royal St. Lawrence Yacht, Montreal; Royal Thames Yacht (London); Royal Nova Scotia Yacht Squadron (Halifax); Royal Cape Breton Yacht; Royal Montreal Golf; Forest and Stream; Montreal Hunt; Montreal Jockey; Auto and Aero; Montreal Racquet; York (Toronto); Tuna Club of Santa Catalina (honorary).

He married Ethel, daughter of W. D. Matthews, Toronto, in 1902, and resides at 355 Peel Street, Montreal.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	$13 65	
Lake Superior, charcoal, Chicago	16 00	
Ferro Nickel pig iron (Soo)	25 00	

	Montreal.	Toronto.
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	19 00	18 35
Victoria, No. 2X.......	18 75	18 10
Victoria No. 2 Plain...	18 50	17 85

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.05
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.05
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh	1.20
Tank plates, Pittsburgh	1.20
Beams and angles, Pittsburgh	1.20
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.15
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAILS AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails..,		75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb. off
Nuts, Hexagon, all sizes..	4½ per lb. off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright ......85, 10, 7½, 10, 10 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off	
Wood screws, flathead, Bronze ....70, 10, 7½, 10 p.c. off	

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 75	$15 75
Electrolytic copper	15 50	15 25
Casting copper	15 00	15 00
Spelter	5 25	5 25
Tin	37 00	41 65
Lead	4 85	5 30
Antimony	8 50	8 50
Aluminum	20 00	19 00

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4.50	4.40
Queen's Head, 28 B.W.G.	4.40	4.65
Fleur-de-Lis, 28 B.W.G.	4.20	4.45
Gorbal's Best, No. 28	4.40	4.65
Viking metal, No. 28	4.20	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal	0.22
Pure turpentine	0.69
Linseed oil, raw	0.61
Linseed oil, boiled	0.64
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.17

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., May 4, 1914.—Another week has gone, and conditions show but little, if any, improvement. Navigation opened last week, and this has, of course, resulted in a certain movement of goods westwards, but, generally speaking, trade is now very much quieter than this time a year ago.

In the machinery business there is little to report, a few orders for single machines being all that have materialized during the past week. The Foss & Hill Machinery Co. have found that the present scarcity of money is having a stimulating effect on the sale of second-hand machine tools, many people apparently purchasing these just now with a view to economy. This firm also reports a good trade in concrete mixers and general contractors' supplies, the present fine weather having resulted in a considerable increase of activity in the building trade.

The Canadian Vickers Company have been busy during the past few days carrying out repairs to the Donaldson liner "Saturnia," which went aground last week below Quebec. She was considerably injured, but came up to Montreal in due course under her own steam. By April 30 she had discharged her cargo, and was taken down to Maisonneuve to be dry-docked. A thorough survey of the damage sustained was at once made, and it was found that a number of plates had been cracked. The work of repairing these was commenced at once, and the ship will be undocked again to-morrow morning, after being in dock only 3½ days. This is a very creditable performance, and has excited much favorable comment in local marine circles.

The new mill of the Colonial Wire Manufacturing Co. is now in operation, and is turning out all kinds of steel wire, as well as fence staples, wire nails, wood screws, etc. The plant of the allied concern, Canadian Rolling Mills Co., Ltd., will be completed in about two months from now.

The pig iron situation remains practically unchanged. A few of the larger concerns have placed contracts for second half delivery, but for the most part consumers are chary of committing themselves and prefer to buy in small lots from month to month, according to their immediate needs.

Copper prices remain the same as for the past two or three weeks, the market being still very dull. Tin is a little easier at present, though local dealers have not yet altered their price.

Toronto, Ont., May 5, 1914.—Business men will probably become less pessimistic in their outlook on trade conditions upon receipt of favorable news from the West. Reports state that the seeding conditions are very good, which should have a beneficial effect on trade generally, but to what extent cannot very well at the present time be predicted. An improvement in trade will be welcomed, whatever the cause, for times are dull, and a spirit of caution seems to prevail. Whatever may be the opinion as to the merits of the deal between the Government and the Canadian Northern Railway, details of which have recently been made public, there is no doubt that it will have a beneficial effect on trade, in certain quarters, especially among makers of railway equipment. The Transcontinental road will be finished and put into operation with as little delay as possible. A considerable amount of rolling stock will be required, which will create keen competition among makers of railway equipment.

The much-discussed purchase of the Toronto Street Railway by the City, seems likely to fall through. The capital stock of the railway is to be increased by one million dollars which it is supposed will be spent in improving the service generally and possibly in further extensions to the system. Increased activity along the water front is noticeable, and the shipping season will soon be in full swing. We understand that the lake navigation companies are looking forward to a heavy season in the passenger business. Shippers have been very busy at the principal lake ports in Ontario since the opening of navigation; it is probable, however, that the amount of freight handled this season will be below the average.

A condition of extreme dullness prevails in the steel trade and no improvement is in sight. The advancement of the season and consequent increase in the demand for structural shapes that would naturally be expected, has not, so far, brought improvement. Prices are being maintained, but for how long it is difficult to say. Reports from Pittsburgh state that the steel works are still running at reduced capacity and that a pessimistic spirit prevails. It is highly probable that the Dominion Government will make a further revision in the tariff on structural steel to meet the conditions prevailing in this country. The rolling mills are asking for a duty of $7 per ton which would enable them to raise the necessary capital to extend their plants. The bridge works and allied interests have, however, to be considered and an equitable adjustment made.

No change in the pig iron market is to be noted this week. Consumers are calling for light tonnages, and prices remain at the same level. It is reported that many blast furnaces in the United States are selling below cost and so incidentally losing money.

The machine tool business is quiet and only small orders are being booked. A local concern report having sold a Warner & Swasey lathe and some small tools to a new firm starting in Hamilton. It is hoped that some business will result upon the final adjustment of the C. N. R. deal, already referred to.

Weakness characterizes nearly all departments in the metal market. The volume of business is, however, a little larger than that of the previous week.

Prices remain unchanged and there is still a scarcity of lead.

Ottawa, Ont., May 4, 1914.—The new tariff bill has now passed the Commons and must now run the gauntlet of the Upper House. During the final discussion of the bill, Hon. W. T. White placed before the House some interesting information in regard to prices of American and Canadian mowing machines and harvesters, freight rates and cost of production, all showing that the Canadian manufacturers are at considerable disadvantage in competing in the Canadian North-west.

Before making the changes he did in the tariff, Mr. White made a most thorough examination into the whole question. A representative from the office of the Finance Department examined the question of cost production in the factories of the International Harvester Co. at Chicago and at Hamilton. In addition, a representative from the Customs Department was sent to the Canadian agricultural implement manufacturers as well as to those engaged in business in the United States and to their agents along the border with a view to ascertaining as accurately as possible the difference in the selling price of agricultural implements on either side of the line.

Binder Price Comparisons.

"So far as the East," said Mr. White, "is concerned, there is very little difference in the price of agricultural implements on either side of the line." The difference in the West he showed was only some $10 in favor of the American machine. Mr. Costello of the Customs Department who conducted the inquiry gave the following information as to comparative cash prices on delivery of eight-foot binders:

United States: Fargo, $147.50; Grand Forks, $147.50; Valley City, $150; Devil's Lake, $150; Lansford, $160; Minot, $160; Gardiena, $160; Williston, $165; Havre, Mont., $190; Great Falls, $190; Billings, $190.

Canada: Winnipeg, $160; Brandon, $160; Weyburn, $165; Regina, $165; Calgary, $170; Edmonton, $170.

From a thorough investigation into freight rates it was found that the freight charges upon an eight-foot binder from Chicago to the undernoted places were as follows:—

Minot, N.D., $12.87.
Gardiena, N.D., $12.87.
Williston, N.D., $14.82.
Havre, Mont., $22.81.
Great Falls, Mont., $23.01.
Billings, Mont., $21.84.
Winnipeg, $10.53.
Brandon, $12.09.
Weyburn, $15.79. Regina, $16.18.
Calgary, $22.03. Edmonton, $22.03.

From Hamilton the prices were as follows:—

Winnipeg, $12.80.
Brandon, $14.40.
Weyburn, $17.40.
Regina, $17.80.
Calgary, $24.00.
Edmonton, $24.00.

Mr. White, in discussing the facts he had secured in committee, added: "The committee will bear in mind two things. First, that the Canadian manufacturer is at a disadvantage in respect of freight rates, which are higher from Toronto or Hamilton to the Canadian West than they are from Chicago. Second, the cost of production in Hamilton, as shown by the returns of the International Harvester Company, are considerably higher in that city than they are in Chicago. Bearing these two facts in mind, the committee will have one explanation at least for the fact that the cash price of agricultural implements is somewhat higher in the Canadian West than it is across the line."

Steel Duties Revision.

Through a misunderstanding or misquoting Mr. White, the story got abroad that there would be a further revision of steel duties. This was corrected later by the Finance Minister, who said that when the new duty of $7 per ton on structural steel is put into force, which may be two years from now, owing to the fact that bridge builders and other interests may be affected, it might be necessary to readjust the tariff then. "I may say," added Mr. White, "in order that there may be no doubt whatever about the matter, that it is not the intention of the Government to introduce any further tariff changes at this session of Parliament."

St. John, N.B., May 2, 1914.—Business continues encouraging in St. John and vicinity so far as the industrial world is concerned. Some of the local plants are making alterations or additions to their premises to keep in line with increased requirements, but there has been no word of the establishment of any new industry during the last fortnight or so. The lumber mills have almost all resumed operations after the idle winter months, and this means considerable activity. Extensive repairs have been made on most all of the different plants.

One of the city's most prosperous houses of industry suffered a serious setback this week when the plant of the Christie Woodworking Co., on city road was totally destroyed by fire. The damage is estimated at about $40,000 with about $20,000 insurance. They had many heavy spring orders on hand besides a large stock. The firm will endeavor to carry on their business for the present in their other big factory on Erin street, but it is expected that they will rebuild on the old site. The opinion of some of the firm is that the fire was the work of an incendiary.

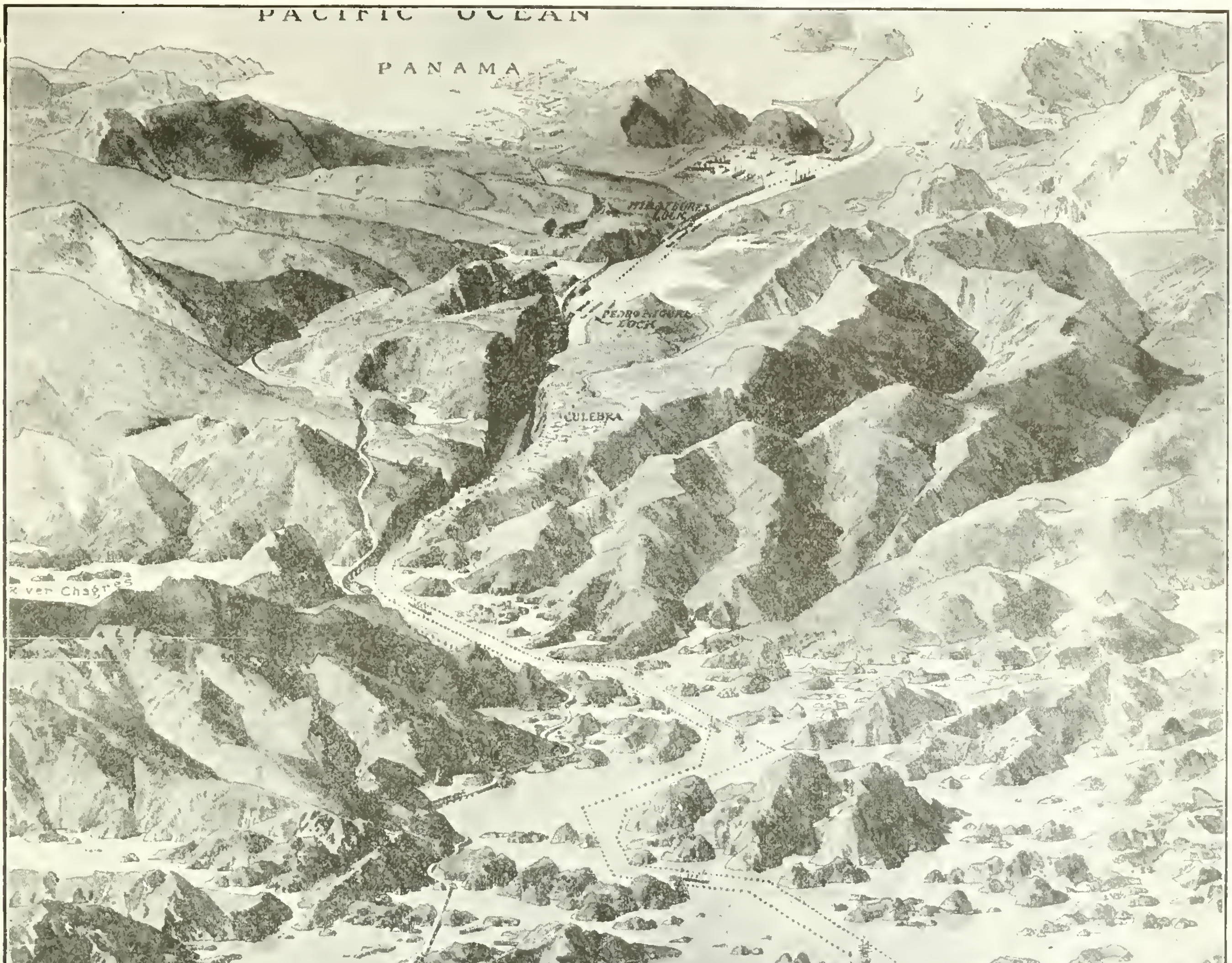
The connection of Connolly and Charleson, contractors, of Ottawa, with the extensive harbor developments in St. John has ceased and their interests have been completely taken over by the Maritime Dredging Co. Manning W. Doherty, general manager of the latter concern, confirmed this statement this week, and said the purchase price was between $50,000 and $60,000. The plant includes the tugboat "Falmouth," two steel scows, pile driver, two lighters, cables, and other accessories, and these are now being used by the Maritime Dredging Co., in their reclamation work at West St. John.

Many friends throughout the Maritime Provinces and in different centres of Canada will learn with regret of the death of George H. Waring, president and manager of the Union Foundry & Machine Works, West St. John. He was 65 years of age and had built up a splendid business. He first started in Indiantown, and later was one of the firm of Waring, White & Co., builders of the St. John Iron Works. Mr. Waring was active in civic matters and had for several years been a member of the town council. His death occurred in Killingly, Conn., where he had gone for his health.

The big C.P.R. hotel, the "Algonquin" is to be rebuilt. It was destroyed by fire at St. Andrews a short time ago, but will be replaced by a larger and more modern structure, the contract for its erection having been granted to Robert Clark of Montreal.

It is reported that the sardine factory at Chamcook, N.B., which was built a short time ago at a heavy expenditure, will not be operated this year but will be sold.

Workmen's Compensation.—At last the Workmen's Compensation Act is a reality. To all intents and purposes the Bill is now law. It passed the third reading in the Ontario Legislature a few days ago, and only the assent of the Lieutenant-Governor is necessary to enable the work of appointing the commission and the organization of the Department to proceed. The announcement of the Speaker—" Moved that the Bill do now pass "—provoked loud applause from both Treasury and Opposition benches. The event was particularly gratifying to the Labor representatives present in the galleries of the House, who have been untiring in their endeavors to see the Bill finally through.



BUILT AT A COST OF SOME $335,000,000. THE PANAMA CANAL—A BIRD'S-EYE VIEW.

It is impossible to say at the moment when that great engineering work, the Panama Canal, will be opened for general traffic; for recent indications show that the Culebra Cut continues to be a difficulty. In length, the Panama Canal is some fifty miles from deep water in the Atlantic to deep water in the Pacific. The cost estimated for the completion of the Canal is $335,000,000, a total which includes $20,000,000 for sanitation and $7,500,000 for civil administration, but does not include the $41,250,000 paid to the New French Canal Co. and the $10,000,000 paid to the Republic of Panama for property and franchises. The Gatun spillway, which is a crescent-shaped concrete dam, 808 feet long, holds back the water of Gatun Lake during the dry season and regulates the overflow during the rainy season. The Gatun Lake, formed by impounding the water of the Chagres River, has an area of 164 square miles, and the Canal channel through it is 500 to 1,000 feet wide, and from 39 to 47 feet deep, according to the season of the year.

—Cut, Courtesy Illustrated London News.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Wheatley, Ont.—Marvin White, owner of the electric light plant here, is about to build an extensive addition.

Hamilton, Ont.—The Steel Company of Canada has reopened its blooming and billet mills, and 200 men will be put to work.

Belleville, Ont.—The Walker Foundry suffered by fire on April 30. Many patterns were destroyed, but the fire will not prevent the firm from doing business.

Little Current, Ont.—The property owners last Monday voted in favor of a by-law for a civic electric plant by a vote of 87 to 4. A loan of $12,000 will be raised.

Redcliff, Alta.—Work on the addition to the Ornamental Iron Works plan here is now almost completed. It is the intention of the management to install new machinery which will mean an increase in the staff as soon as this machinery is ready for operation.

New Westminster, B.C.—A new company, composed of Messrs. Stewart, Moore & Wright, of Vancouver, has taken over the D. & H. Brassworks Co., at Sapperton. Two acres of land have also been purchased and a foundry and steel plant will be built.

Belleville, Ont.—The Walker foundry was partly destroyed by fire after 6 o'clock on April 30. The blaze broke out in the pattern shop and storage room on the third floor of the building. It was on this storey that the damage was greatest, many patterns being destroyed. The roof was partly burned, but the fire will not incapacitate the firm. The building, which was of stone, was owned and the plant operated by McCarthy & Wright.

Electrical

Galt, Ont.—In order better to serve the large manufacturing establishments on the west side of the river here, a substation of the Hydro-Electric Commission is being erected.

Renfrew, Ont.—The town will probably install an ornamental lighting system. An estimate has been submitted by the Hydro-Electric Commission which calls for an expenditure of about $8,300. Iron standards and electrical equipment will be required.

Newmarket, Ont.—Three members of the Electric Light and Power Department of the town resigned their positions on May 1. No reasons were given for the resignations, which take effect on May 30. Those who resigned were: Wm. O'Hara, chief engineer; Walter O'Hara, second engineer, and Alf. Bursey, third engineer.

Municipal

New Westminster, B.C. — The city decided to purchase some fire fighting apparatus.

Barrie, Ont.—The town council have recommended that $1,000 be spent in the installation of a fire alarm system.

Point Grey, B.C.—The council have adopted a resolution to investigate a proposal to grant a gas franchise in the municipality.

Toronto, Ont.—The Board of Control reported funds to the amount of $74,504 for the construction of the temporary incinerators.

Montreal, Que.—It is announced that the Board of Control will open negotiations to expropriate the plant of the Montreal Water & Power Co.

Picton, Ont.—A by-law to spend $20,000 on a permanent roadway for Main Street was voted on here last Monday and carried by two hundred majority.

Woodstock, Ont.—The county council have decided to spend $60,000 on improving the roads in the district. A bylaw will be voted on to authorize raising a loan.

New Westminster, B.C.—Seagrave & Co.'s tender for two combination hose and chemical trucks for the fire department will probably be accepted. $15,200 is the price quoted.

Bridgeburg, Ont.—The proposed good roads by-law will be voted on by the ratepayers on May 18. The by-law provides for the borrowing of $7,001 on ten year five per cent. debentures.

Tilbury, Ont.— The town council has concluded a deal with Thomas Vickerman for the purchase of the electric light plant for $5,000. Part of the plant will be used for the installation of the hydro system, which it is expected will be in operation here sometime this year.

Calgary, Alta.—The ratepayers on May 1 voted down seven of the ten bylaws submitted. The by-laws which carried were $20,000 for public market extensions, $250,000 for water works extension, and $100,000 for sewer extensions.

Englehart, Ont.—It is likely that the sewerage and water systems will be installed shortly. At the last meeting of the council a by-law authorizing the selling of debentures for the sum of $28,000 was passed. It is expected that the T. & N. O. will give their portion and that the work will soon be started.

Transcona, Man.—The town has submitted to the Provincial Board of Health for approval plans and specifications for a water works and sewage disposal system. A bylaw to raise funds for this work will be submitted shortly, and if carried the work will be begun at the earliest possible moment. It is thought that a sum of $250,000 will cover the expense.

Berlin, Ont.—There is every indication that Berlin will be included in the natural gas belt of Western Ontario in the near future. The Light Commission is negotiating with a company owning the Petrolea gas field, and expects to enter into a contract for a supply to be delivered within the next two months. Natural gas will cut the present gas prices to the consumer in half.

Duncan, B.C.—Work on the new civic lighting plant will probably start in the course of a month. Tenders are being called for the erection of a building of brick construction, suitable for the purpose, on a site previously purchased. The tenders will probably be opened at an early date. When the new plant is in operation it is expected that there will be sufficient current available to furnish all demands.

Sudbury, Ont.—Mayor O'Connor announces that it has been decided to proceed with the construction of pavements at a cost of $100,000 and that a $50,000 sewerage system also would be installed in the near future. He expected that street railway lines would be built by the Sudbury and Copper Cliff Railway Co., while the permanent pavements were being laid. A Toronto firm of consulting engineers has been retained.

The New Steel Car Shops of the C.P.R. at Angus, Montrea

By L. C. Ord *

The accompanying article formed the subject of a paper read before the Canadian Society of Civil Engineers, Montreal, on April 30, and by its contents indicates not only the faith of the C.P.R. management in the greater serviceability of steel cars, but that corporation's enterprise in equipping themselves to produce them as far as possible to fill their own requirements.

THE Canadian Pacific Railway decided to build at their Angus shops, Montreal, for the construction of steel passenger and freight cars, a plant having a capacity for building ten passenger cars per month and eight freight cars per day. At the time the steel freight car shop was built many thousands of steel frame freight cars had been built by contracting shops, both in the United States and in Canada, to the same design as the cars for which the new shops were intended.

As it was anticipated that the greater number of the cars built would be steel frame box cars, the design and lay-out of the freight shop was considered solely with reference to this type of car, in order that the work might be done as cheaply as possible. In designing the shop, 2,750 sq. ft. of floor area was allowed per car per day. To prevent the overcrowding which is common in most steel freight car shops and to allow for the greater amount of room taken up by spacing punches, larger machine room was provided. The final floor area for the freight shop was made 41,785 sq. ft., and the area of the machine shop 22,069 sq. ft., less 7,265 sq. ft. which was set apart for machining and assembling steel centre sills for repair work, giving a total area of 14,795 sq. ft., available for machines. The area of the assembling portion of the freight shop was 9,170 sq. ft., while the erecting area was 17,820 sq. ft.

At Angus a shop already existed for building trucks for both passenger and freight cars, and the trucks are therefore erected, assembled and delivered to the steel shop complete in every respect. There was also a freight shop for building and painting wooden freight cars. In this wood shop, therefore, the steel cars have the floors, lining and roofs applied, except in the case of some all-steel roofs. The existing large blacksmith shop made it convenient to arrange that no forging or hot bending work of any sort should be handled in the steel shop, the necessary rivet furnaces being the only ones in the steel shop.

Lay-out Features.

In Fig. 1 is shown the general lay-out of the section of Angus plant for the convenient location of the wood mill and wooden freight car shop for the finishing and painting of the steel frame box cars, also of the truck shop and of the lorry and overhead crane arrangement for handling the supply of material from the truck and blacksmith shops. The steel shop proper consists of two 100-ft. bays running parallel with the front of the shop, and, at right angles to this, one 72-ft. bay 405 ft. long. The passenger shop erecting section is composed of four 27 ft. 6 in. bays 202 ft. 6 in. long, running at right angles to the hundred-foot bays and parallel to the freight section.

The crane service comprises a 10-ton traveling crane 96 ft. 3 in. span on a runway 309 ft. long in front of the shop, covering the material section and parallel to the cranes in the shop and of the same height and span. Inside the shop there is a 10-ton crane 96 ft. 3 in. span in each of the 100 ft. bays. These cranes all have a headroom of 27 feet.

In the erecting section on the freight side there is a crane of 10-ton capacity 67 ft. 7 in. span with a head room of 35 ft. 6 in. In the passenger shop four traveling cranes 24 ft. 10 in. span of 2-

*General Car Inspector, C.P.R., Montreal

GENERAL VIEW OF STEEL FREIGHT CAR ERECTING SHOP.

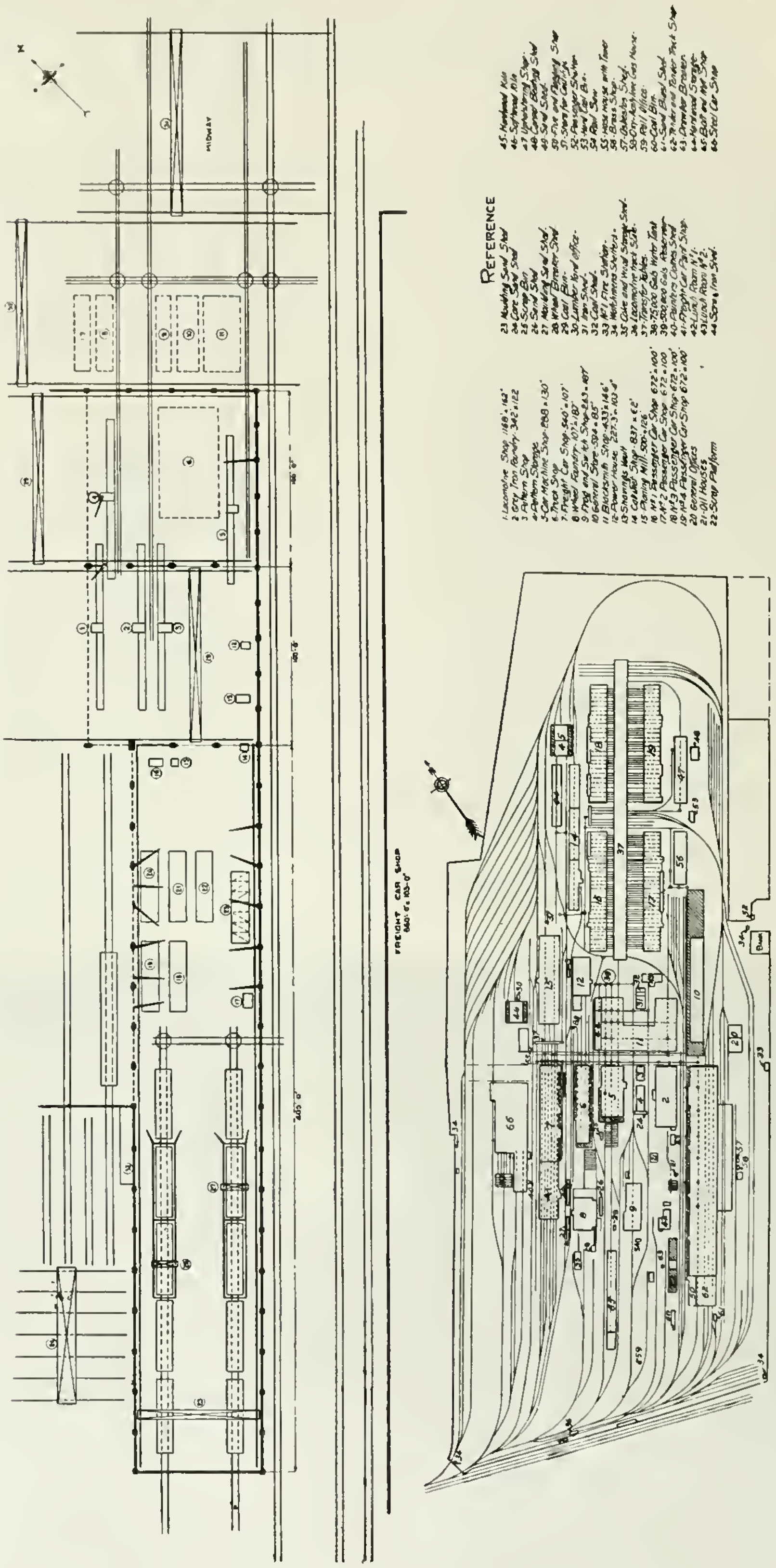
ton capacity with 20 ft. headroom are used. They are for the handling of material for the passenger car work and are operated from the ground. A noticeable feature is that these runways are carried into the main shop about 8 ft. under-running the overhead traveling crane to assist in the transfer of material from one crane to another.

The building is steel with brick walls, steel sash being used, and care has been taken to provide a large amount of light, the area of light being approximately thirty per cent. of the total wall space.

The floor in the shop is mastic throughout and is an asphalt composition in two ⅝-in. coats, the top being a wearing and the bottom a cushion coat or a concrete base 4 inches thick. After considerable use of this type of floor in various parts of the plant, a floor of rather harder consistency than usual was selected, and although marks will occur if heavy weights are left on it for some time, yet when these weights are removed the marks gradually work out. This floor does not crack or break if anything is dropped on it, as in the case of cement; it is also very much easier for walking or working on, is waterproof and easily kept clean and free from dust. The crane runway on the midway runs the full length of the plant and far enough in front of the steel car shop to load and unload material from the first two material tracks running through the storage space. The storage space in front of the shop is arranged so that should it be found advisable to extend the shop in order to afford a cover for the material, to provide for additional machine room or for any other purpose, the crane runway might be transferred to the opposite side of the midway and still be used for the storage of material.

Supply tracks run east and west through the storage space at intervals suited to the arrangement of the machines inside and to the storage of the material outside. Through tracks for the handling of freight cars under load are located at the north of the bay for passenger car material and at the south for material for freight cars. The material is unloaded direct from the cars to the proper piling space, conveniently located with relation to the supply tracks. With this arrangement the material handling is reduced to a minimum and the supply to the shops is for the most part independent of the overhead traveling cranes, which are used principally for unloading cars and handling large quantities of specially heavy material.

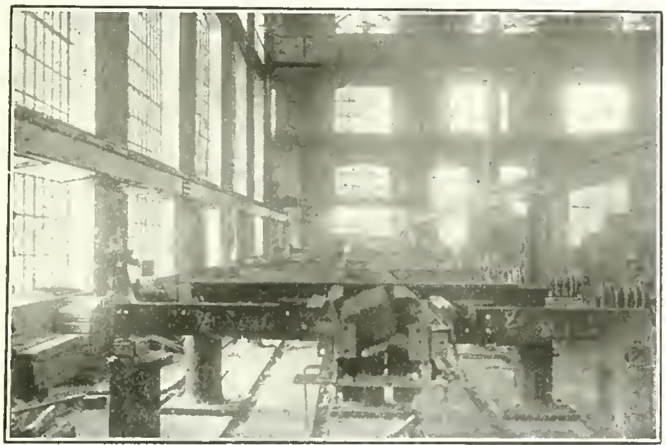
In the front portion of the steel shop are two long bays 100 ft. wide. The first bay is 209 ft. 6 in., and the second 182 ft. in length, one bay being longer than the other in order to allow for unloading directly into the shop any material which it is necessary to keep under cover. The arrangement of the two long bays with traveling cranes running crosswise to the tracks in the shop was particularly suited to the spacing tables and types of machines installed. The crane in the front section is used to supply the material to the machines, through which it is carried automatically into the next bay, where the second crane distributes it from the machines to the various points in the shop requiring it. An effort was made in the lay-out of the shop to use machines with a relatively small capacity, but sufficient in number to prevent the expense and delay of changing dies and setting up, and avoid the big accumulation of ma-



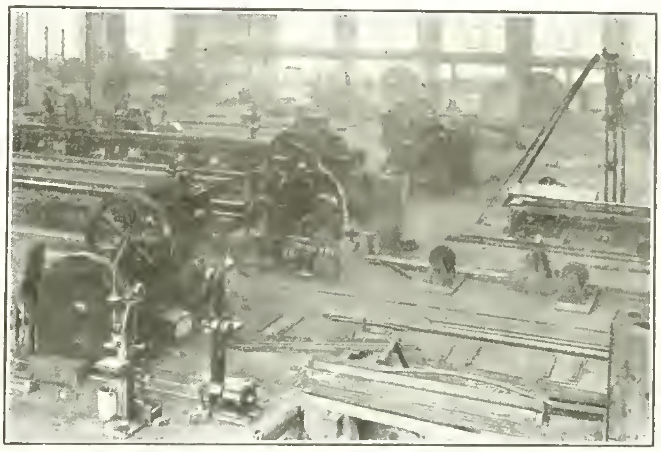
THE UPPER DIAGRAM SHOWS THE STEEL SHOP (FREIGHT CAR SIDE), LAYOUT AND THE LOWER DIAGRAM THE GENERAL PLAN OF THE C.P.R. ANGUS SHOPS, MONTREAL.

terial necessary to feed the shop without delay when one large machine is used for several purposes.

In the freight shop four spacing punches are used. One of these is fitted specially for punching 6-inch Z-bars for steel centre sills for repairs on the line, and is not concerned in any way

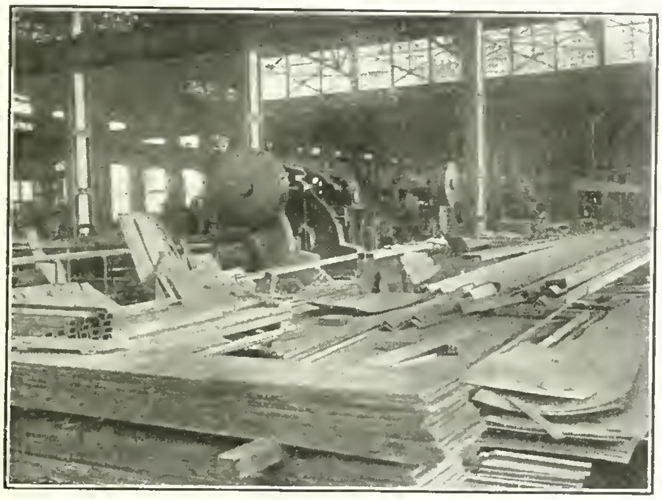


ASSEMBLING FRAME FOR STEEL PASSENGER CAR WORK, SHOWING THE CRANE RUNWAY.

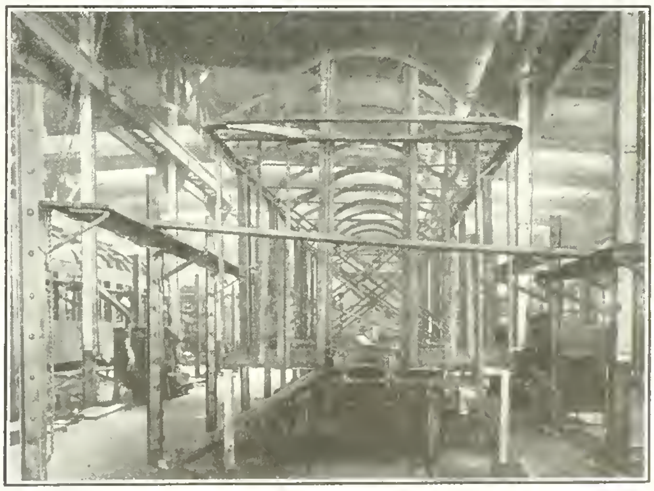


GENERAL VIEW OF MACHINE SECTION SHOWING SPACING TABLES IN FOREGROUND.

with the steel car work. This machine is fed by an independent lorry track. The Z-bars require to be punched twice, once for the flanges and once for the webs. The material is run in beyond the punch and is handled through it to the front of the shop. Specially arranged air jacks are used for lifting the Z-bars to place on the rollers which feed the machine, and also for unloading the punched Z-bars from the machine.. Skids are so arranged that the Z-bars



STEEL PASSENGER CAR SHOP FROM BACK OF HEAVY PLATE SHEAR



FIRST POSITION IN PASSENGER CAR ERECTING SHOP SHOWING ARRANGEMENT OF SCAFFOLD POSTS.

are lifted and skidded off the machine without being touched by hand in any way. It has been found cheaper and quicker to run a quantity of bars through one operation, and when a considerable number have been punched, to move them back for the second operation, which of course requires a change in the set-up of the machine. On the last operation, instead of unloading to the material space at the side of the machine, the Z-bars are skidded in the opposite direction on to the rails, where they are required for assembling for draft gear, etc. From these skids they are slid on to the trucks which take them to the front of the shop where the couplers and draft gear are fitted. They are then either loaded direct to cars for shipment on the line or used in the freight car shop where heavy repairs to existing equipment are made. The second spacing punch is used for the side plate of the car (a 4-inch Z), and floor stringers, which are 3 in. Z. The capacity of this machine is well above present requirements.

One spacing table is used for punching the webs of channels (centre sills 15-inch and side sills 8-inch), while another machine punches the flanges of these same channels. The machine which punches the webs of the channels does the work in one operation and has, therefore, double the capacity of the flange machine. With the present output of the shop, the web punching machine works as above for only one-half of the time, the balance of the time being used on cover plates and similar flat work. An additional punch for the flanges has been installed and the foundations for the spacing table laid out so that without disarranging the handling of the material, by adding a spacing table to the existing punch, it will be possible to double the output of these machines. This spare punch is used for hand work at the present time. With the provision of the spacing table on this coping punch and an extra coping punch, practically no other additions would be necessary to run the machine capacity of the shop up to twenty-five cars per day.

In the event of a breakdown of any of the punches employed on this spacing table work, serious delay to the output could not possibly be avoided. As additional heavy punches of coping, slotting, etc., were necessary, it was arranged to purchase machines which are duplicates of those used on the spacing tables. If at the present time any one of

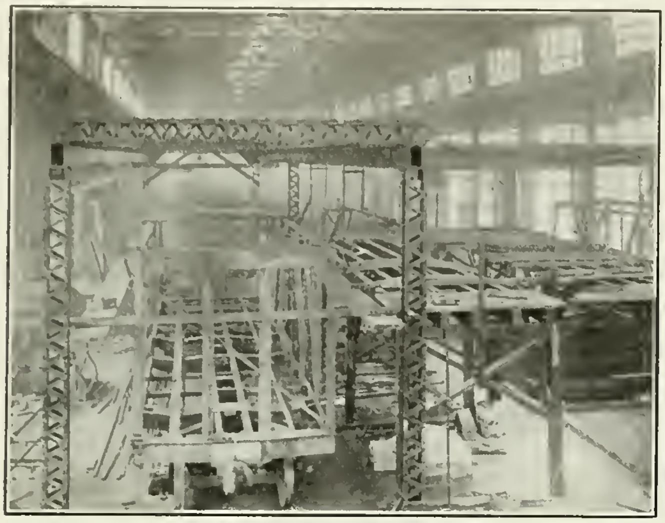
the punches on the spacing tables should become totally disabled, it would be possible to substitute another punch or part of a punch with short delay and keep the shop running, as in the case of punches for coping and similar work, substitutions could readily be made. On all the machines used in the shops the interchange of punches, gags and other jigs have been closely considered to prevent delay, or the necessity of large stocks being carried.

The piling space outside is arranged so that the material can be skidded on to the lorries by hand and taken to the spacing punches and other punches by hand, which in case of trouble with the overhead crane saves a great deal of time. Care was taken in the case of the heavy material, such as the centre and side sills, to arrange that each movement should be short and easily handled. The first movement from the pile is to the web punching machine, from which the sills are handled by small cranes and rollers to the flange punching machine, without any backward movement. On the flange punching machine, the sills are bolted together in pairs, run through the machine, brought back through the machine, turned over and handled through a second time to punch the lower flanges.

The design of the spacing tables is particularly convenient as each of the templates has two lines of gauge points and, therefore, the punching of both pairs of flanges is done on a sill from the same template. From the last movement on the flange punching machine, the material is unloaded on to the floor, where a very large space has been reserved to allow of a considerable accumulation of finished centre and side sills, to prevent the possibility of delay on these very important items. The small track on which the finished Z-bar centre sills are taken out of the shop is also used to supply the Z-bar sections to the small spacing machines. This double lorry track arrangement prevents the crowding which would be inevitable if all the material were handled over one supply track.

The centre sills when punched on the webs and flanges also require to have slots punched in them to accommodate the draft gear and brake pipe. These slots are made on a coping punch so arranged as to require no backward movement of the material. This die is left set up on the machine all the time, but is so arranged that small dies can be set up beside the large ones to enable the machine to be used for light punching when not punching slots. One other coping punch is fitted up with dies for making the various mitered cuts and coping the side posts and braces. The coping punch beside the Z-bar machine is fitted with a special die for coping the side plate. Three high-speed punches are used for all the various small punching work around the shop, with the exception of the diaphragms which are punched on a horizontal punch. This completes the machine equipment for the steel shop, but it must, of course, be borne in mind that the hot forging, upsetting and bending work are done in the blacksmith shop and material is brought into the steel shop already finished.

Special attention has been given to



ERECTING FRAME FOR STEEL FREIGHT CARS, SHOWING METHOD OF STORING AND APPLYING CARLINS.

VIEW OF FREIGHT CAR SHOP SHOWING OVERHEAD CRANES FOR HANDLING COMPRESSION RIVETERS

FIRST AND SECOND POSITION OF STEEL FREIGHT CARS DURING ERECTION, SHOWING ONE SIDE OF CAR LIFTED INTO PLACE, ALSO THE ARRANGEMENT OF CRANE WHICH WILL LIFT ON THE OTHER SIDE.

the handling of material to make this, as far as possible, independent of the overhead cranes except for the movement of large quantities of heavy pieces. For this reason the shop is particularly well equipped with air jacks, skids, overhead fixed hoists, traveling hoists on runways and swinging jib cranes. To reduce the labor and the cost of handling and of repairing, ball bearings and roller bearings are used throughout on jibs, hoists, hand traveling cranes and material rollers. Special care has been taken to have definite room allowed for the piling of material outside the shop, for the storage of material around the various machines and the storage and accommodation of the finished material. Specially constructed racks are used throughout the shop. To maintain the orderly handling of the material, painted lines are used to define the boundaries of these piles and mark the passage ways, which are always kept clean of material. These boundary lines are repainted at the end of each week, at which time an absolute clean up is made of any material which would otherwise tend to accumulate.

Punching Equipment.

The Thomas spacing tables are of the semi-automatic type. The movement of the carriage is controlled automatically, while that of the gags for bringing one or more punches into play at each stroke is controlled by hand. The tables are electrically operated, their movement being controlled by two templates 7/8 in x 3 in., having a double row of steel pins. They are so arranged that when the trip on the moving portion of the table engages the pin it automatically stops and locks the material to be punched and at the same time, by means of an electric magnet, operates the clutch on the punch. The punch head, after coming down and punching the material, on its return stroke disengages the carriage and the clutch on the punch and automatically starts the movement of the material. The operation is repeated as each successive pin is encountered. The particular value of this type of machine is that templates may be made up of wooden strips with pins driven in at very short notice and small cost, while permanent steel strips with inserted pins can be made up for permanent work. The strips can be changed in a few moments and are kept at hand for the various classes of material to be handled. The accuracy of the work practically depends upon the accuracy of the template, and the results obtained are extremely satisfactory.

High-Speed Punches.

The high speed punches were designed specially for this shop by John Bertram & Sons. They run at the high speed of 60 strokes per minute and are entirely without gears, being belted from the motor direct to the flywheel of the punch. The clutch is of the six point type. Two punches are fitted in each head, both being controlled by a single gag lever which has three positions, one for each punch and a neutral position. These high-speed punches are not equipped with spacing tables, as it was found that on account of the slower movement of the carriage on the spacing table and the consequent time lost in entering the piece, hand punching for small light pieces was cheaper, providing the same could be made sufficiently accurate. To do the punching more accurately, the method adopted was that of using a drilled or punched template and of butting the piece against a gauge inserted in each successive hole in the template.

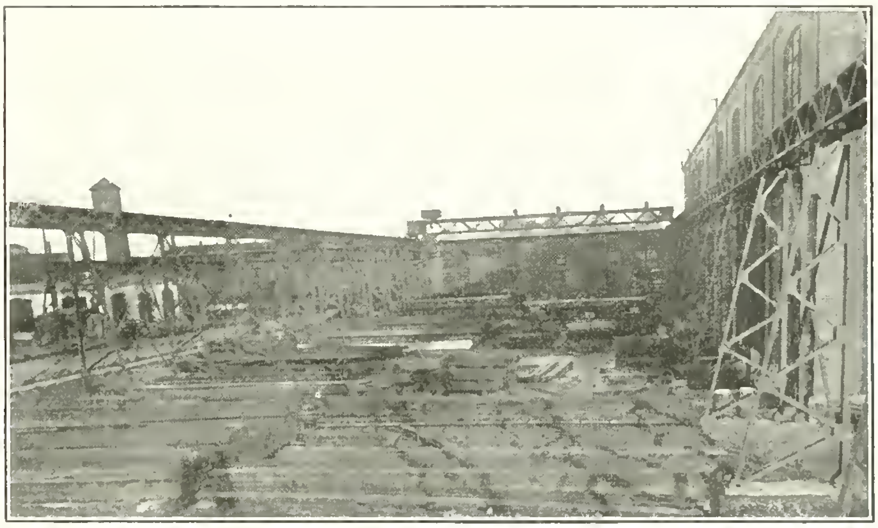
The usual method is to make up a square template at one side of the machine, having one or more rows of holes punched in it on each of the four sides, some having as many as eight different rows of holes, each row being used as a template. The material is moved along the top of the gauge until it butts against a pin inserted in each hole in turn. It is found that for certain classes of work the gag is thrown in on the punch and the operator can move the material fast enough to catch every hole with the punch running at 60 strokes a minute. This is nearly three times as fast as the rate at which it would be punched on a spacing punch, and the time of setting up and the backward movement of the carriage is saved. While only one piece is handled at a time, the cost of punching light, short material per hole is fully as cheap as when done on the spacing punches.

On some of the punches, where there is little variation in the work handled, single sided templates are used with three or four rows of holes, which take care of the work satisfactorily. No marked-off work of any kind is used in the shop, except for irregular pieces, which cannot be punched in the spacing punches or by the method described here; and most of the other work is punched to a gauge where it is possible to design one. This not only reduces the time in punching and saves the expense of marking off, but greatly increases the accuracy of the work done.

Assembling.

Special arrangements were made for the storing and handling of material in relation to the assembling to reduce the labor to a minimum. With underframes an important gain was made by the use of clamps instead of assembling bolts, the common practice elsewhere. For an assembling bolt, it is necessary to get a full hole before the bolt can be applied; a wrench is also required, and the time spent in this way is greatly reduced by using a clamp with a hinged handle. The clamp is applied between the holes to be reamed, and the time lost in removing the bolt from one hole and applying it in the adjacent hole when reaming is entirely avoided. The clamps are applied by the men assembling. They are not touched by the men reaming, but are removed by the riveters as they work up to the clamps. They are collected from the floor by a laborer and carried back to the assembling position for the next succeeding frame.

In assembling the underframe, a jig is used which accurately locates the centre sills, bolsters and cross bearers. By this method the sills are assembled square, reamed in the same position and then transferred to the underframe riveting jig. This jig consists of a number of cast columns supported on I-beams bolted on a concrete foundation and securely holds the underframe in position while being riveted, so that the



STORAGE SECTION IN FRONT OF STEEL CAR SHOP.

underframe is constructed accurately and square in every way. A great deal of time is thus saved in the assembling and the line of the car when finished is very greatly improved.

To rivet the underframe on the jig by compression riveters without turning it over, it was necessary to have a special type of riveter designed with a thin nose to permit the top row of rivets to be driven and to allow sufficient clearance for the bottom row, particularly on the bolsters, to be driven without moving the underframe. The makers considered that this would be an expensive type of riveter to maintain, but quite the reverse is the case. It is not possible to use a high-speed steel snap for ordinary work, as it is extremely liable to break, but when it is inserted in the cast steel block it is well supported and does not fracture. It is much denser than any other material that could be used. When renewed, the amount of steel is so small that the cost is not considerable, and it has easily proved to be the cheapest type of die, for maintenance, of any compression riveter in the shops.

The movement of the steel sills from the point of assembling to the jig where they are riveted together is handled entirely by small air jacks on trucks running on narrow gauge rails which move the underframe from position to position without requiring the use of the overhead crane. This, of course, saves a considerable amount of time and enables the movements to occur simultaneously, which could not possibly be done if it were necessary for the crane to move them all, as the crane can only handle one at a time. The value of the time thus saved is considerable and easily appreciated. The only portion of this output which is fixed is that of riveting the underframe with the compression riveters, and the capacity is about fourteen or fifteen cars per day. Provision, is, therefore, made for the installation of an additional position for riveting the underframe along the side wall of the building where the jib cranes for handling compression riveters can easily be located. The other positions can easily handle twenty-five cars a day, by the addition of more help where required.

Side Frame Jig.

For assembling the side frame, a jig was designed by which a considerable improvement has been attained over former practice. The side frames for as many cars as are required are built on one jig, all the parts being placed in templates, giving them a fixed location. The riveting on the lower side sill is handled by two suspended compression riveters, the balance of the riveting being done by hand. The parts are at present clamped together by hand clamps, which will shortly be replaced by fixed pneumatic clamps in order to hold them more rigidly and avoid the time lost in applying and removing the hand clamps. Special attention has been paid to the loss of time in locating and applying clamps, and pockets are arranged in the frame so that everything is as close as possible to the point where it is to be used. Even more care is taken in the racks for the material, as each post and brace is piled directly opposite to where it will be used in the frame. A small gantry crane is being constructed to handle this material from the jig to the piling space, so that no time whatever will be lost waiting for the traveling crane.

The same arrangement is made for the end frames as for the side frames, a small traveling crane being used to handle the finished end frames from the assembling sections to the place where they are piled.

Erecting.

The erecting is commenced at a point where the trucks are brought in from the supply tracks at the side of the shop and handled across turntables into proper position. The underframe is then brought down by the traveling crane and placed on the trucks. In the first position, the floor stringers are riveted in place and one end frame is lifted on by a jib crane specially constructed for that purpose. When this is done, the underframe is moved down to the second position, and the side frames are lifted up by two special hoists from the convenient piles where they have been placed by the overhead crane, and the other end frame is lifted to place by a jib crane. In the third position, the carlins and the riveting up on top of the car is completed on an overhead scaffolding which allows the men to work conveniently. There is also an upper floor and special racks for the accommodation of the carlins and other material.

An all metal roof designed by the Canadian Pacific Railway for these cars required special handling. The usual practice was to allow the cars to go out of the shop with the carlins riveted in place, and the roof sheets and various wooden parts of the roof were applied in the wood freight car shop. This roof being all steel with outside carlins, it was necessary to apply the roof sheets before the carlins, and therefore the roof was assembled and erected complete on the cars in the steel car shop in two positions and the cars turned out of the steel shop with the roofs complete in every respect except for the application of the wooden running boards. This is a very unusual feature and the fact that the entire output of the steel shop could be handled in this way is evidence of how readily the roof and carlins are applied. A cut shows the arrangement of upper scaffold platforms which were used for the application of the carlins of the ordinary roofs and for the convenient storage of carlins and roof sheets for the all steel radial roof.

Room for a fifth erecting position is allowed, but this is not required with the present output of the shop. The cars are moved outside by a motor driven car-pull situated in the lower end of the shop, being sent over to the wood shop for lining, roofing and painting, and are then reported for service.

Steel Passenger Car Shop.

The method of handling material in the passenger shop is the same as for the steel freight shop. The arrangement of the machines is similar, except that it is not possible to get enough work of the same class with the relatively small output to use spacing tables to advantage. A coping punch is, therefore, fitted up with rollers for the convenient handling of long material, and the work is punched to gauge much in the same way as on the smaller punches, although considerable marked-off work has been used up to the present.

The operation of the high-speed and other coping punches is also similar to those used in the freight shop. The additional machines comprise plate straightening rolls for straightening or bending plates, and a plate edge planer for the outside sheets for the coaches. A cold saw and metal band saw are used for cutting accurately such material as would not be handled to advantage in the shears. A large gate shear, double angle shear, combination horizontal punch and bending or straightening machine completes the ordinary machine equipment in the passenger shop.

As it has been decided to drill the side plates instead of punching them, a special drilling machine was installed for this work. This is of similar construction to a locomotive frame slotting machine, the plates being laid out on a long table and a traveling head provided, fitted with a number of electric drills. The head, of course, is very light in order to make it easy to handle. Templates with hardened steel bushes for drilling are used as in ordinary good practice.. By laying several sheets one on top of another and drilling a number of holes at the same time, the drilling costs are reduced to a minimum and compare very closely with the cost of punching in an automatic machine besides being necessarily much more accurate, and the drilling does not buckle or distort the sheets or leave a rag on the lower edge as in punching. This is very important for the side sheets on

(Continued on page 483.)

Safety Provisions Relative to Transmission Machinery--III

By W. Sydney Smith

An official report by the Inspector for Dangerous Trades in England, regarding fencing and safety precautions for transmission machinery, has been issued. It explains the structural and administrative safeguards with regard to the several parts of transmission machinery which experience shows to be needed for the protection of persons employed.

OVERHEAD pulleys within reach of the workers should be fenced underneath, Fig. 11, with strong guards of metal or wood, which should be extended to protect the low-lying portions of horizontal and oblique driving bands in order to prevent accidental contact

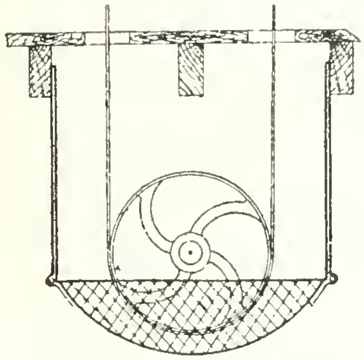


FIG. 11. HINGED WIRE NETTING GUARD FOR OVERHEAD BELT AND PULLEY.

with moving parts, and especially at the intake between belt and pulley, which is the most dangerous part. Accidents are often due to contact with the spokes of pulleys and wheels in motion. Hence the sides of spoked pulleys within reach

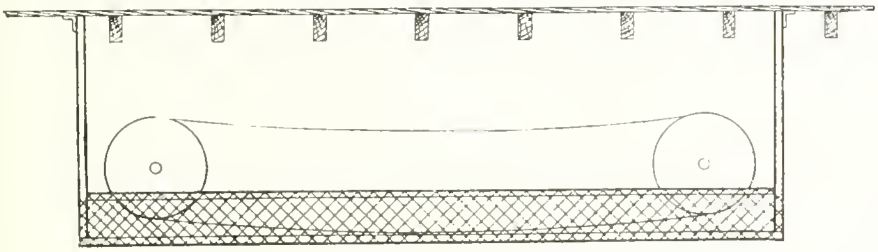


FIG. 12. EXPANDED METAL GUARD FOR OVERHEAD BELT.

of workers, or to which they may have access, should either be fenced or the spokes filled in with circular disks to convert them into plate wheels. The sides of all drums in the grinding rooms of tenement factories are required to be closely fenced, and the need is the same wherever spoked pulleys are accessible to the workers.

Belts, Ropes and Chains.

As regards the fencing of belts, the conditions are materially different from those of shafts and pulleys. Heavy overhead belts which may never be approached whilst in motion, and are to that extent safe by position, often require to be protected underneath as a safeguard in case of breakage; further, the fencing of the low belts driving the individual machines, e.g., looms, lathes, and other machine tools, is in many cases impracticable, and though such belts are strictly mill gearing, little danger arises where metal fastenings are avoided and efficient strap forks are provided.

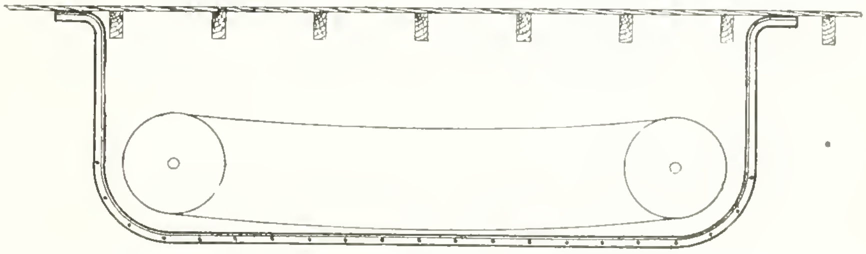


FIG. 13. LADDER TYPE GUARD FOR OVERHEAD BELT

Periodical examination of belts would lessen the number of breakages. Belt accidents would also be reduced by prohibiting the use of projecting metal fasteners, or by requiring all belts with such fastenings to be fenced. There is, however, always risk of accident arising from contact at the intake between belt and pulley or contact with running belts, and fencing is necessary in the following circumstances:—

(1)—All vertical and oblique belts

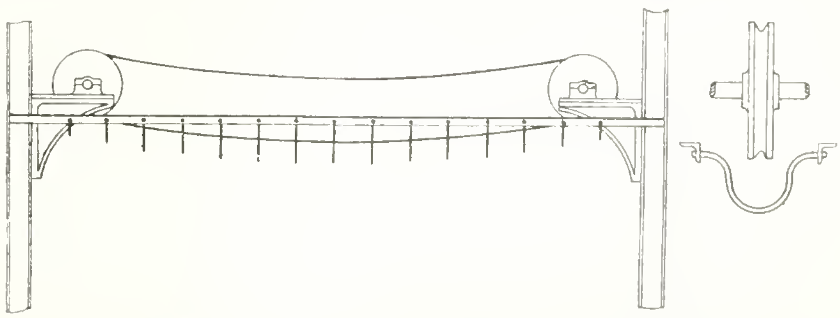


FIG. 14. BOW-SHAPED IRON CLEAT GUARD FOR OVERHEAD ROPE.

(irrespective of size and speed) passing through floors should be fenced around the openings to a height of at least 4 ft. Where the belts are oblique, it may also be necessary to fence the underside of the belt to a height of at least $6\frac{1}{2}$ ft., so as to prevent accidental contact.

(2)—Horizontal and oblique belts used for main driving and counter-driving within $6\frac{1}{2}$ ft. of the floor or other place to which the workers have access while the transmission machinery is in motion, should be securely fenced by rails or casings so as to prevent accidental contact.

(3)—All overhead main driving belts, if more than 4 in. wide and moving with a velocity of more than 30 ft. per second, should be protected underneath with strong guards of wood or metal at those parts where persons are liable to pass under them.

The protection under heavy overhead belts must be substantial, e.g., troughs of wood, sheet metal, perforated or expanded metal, strongly constructed and firmly supported by the walls or beams, (Fig. 12). Ladder-like guards made of angle irons fitted with metal rungs (Fig. 13) or strong bow-shaped iron cleats fixed at intervals (Fig. 14) are also efficient; the latter types will not interfere with the examination of the belt or of a rope and have the advantage that the driving bands or ropes are always visible.

Fencing of other driving-belts, in addition to main-driving and counter-driving belts may be necessary according to position, size, speed or special circumstances, but much judgment and experience are necessary. Low belts near the floor level and high-speed belts should in general be guarded, but each individual case must be considered on its merits as to the degree of danger and the nature of the fencing requisite under the circumstances. Many belt fasteners are dangerous on account of metal projections, but of metal fasteners those consisting of a continuous wire stitching held together by a peg other than a metal peg, are safe.

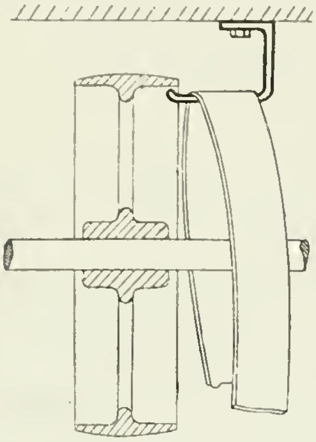


FIG. 15. SIMPLE BELT PERCH.

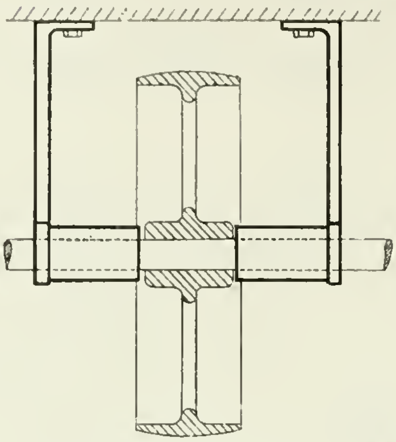


FIG. 16. SLEEVE BELT PERCH.

The fencing of driving ropes, except overhead ropes, should generally be on the same lines as the fencing of belts. There is not the same need for fencing small overhead driving ropes, as ropes never break without showing signs of wear and giving ample warning before breakage by the production of quantities of fluff, unlike belts which generally break unexpectedly.

Driving chains of metal, on account of their weight, are more dangerous than belts or ropes; the intake between a driving chain and pulley being as dangerous as the intake of toothed gearing. Chain belts should at least have a strong trough underneath, whatever thei- position, and if accessible they should be enclosed.

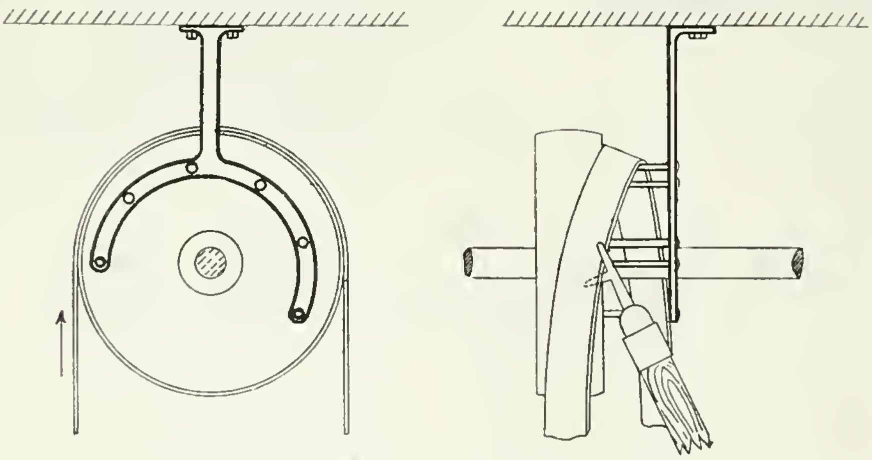


FIG. 18. IMPROVED BELT PERCH.

Belt-Perches.

Belt-perches are closely associated with the fencing of belts. Where machines are worked intermittently, it is a common practice in many factories, after the use of a machine, to throw the driving belt off the shaft pulley until the machine is again required, in order to economize power and to save wear and tear of the belt and pulleys. A belt may also slip off the driving pulley accidentally, or may be thrown off intentionally for the purpose of repairs. It is a dangerous practice, however, to allow a belt under such circumstances to rest on a revolving shaft, owing to the liability of the shaft to seize the belt and wind it up. Accidents, due to falls of shafting and parts of the machinery, have often occurred from such a cause. Many fatalities and serious accidents have also happened to persons on taking hold of a belt resting loosely on a revolving shaft, they having been suddenly carried up to the shafting owing to increase of frictional resistance between the belt and the shaft.

Provision must be made in all cases to keep loose belts out of contact with revolving shafts. There is no danger if the shaft is fenced by a sleeve of metal or other material. In other cases some type of belt-hook or belt-perch must be used, and various forms are available. The simplest (Fig. 15) consists of a strong hook fixed adjacent to the driving pulley, with the horizontal portion somewhat longer than the width of the belt and the end turned up under the pulley rim. Another type, consisting of a sheet-iron sleeve or trough riveted to a bracket, is shown in Fig. 16.

A belt-perch may be fixed on each side of a pulley if it be desired to displace the belt on either side. For horizontal belts, the perch may consist of a simple bracket provided with two pegs as in Fig. 17, fixed near the driving pulley and shaft; while similar brackets may be fixed at intervals to support a long stretch of horizontal displaced belting.

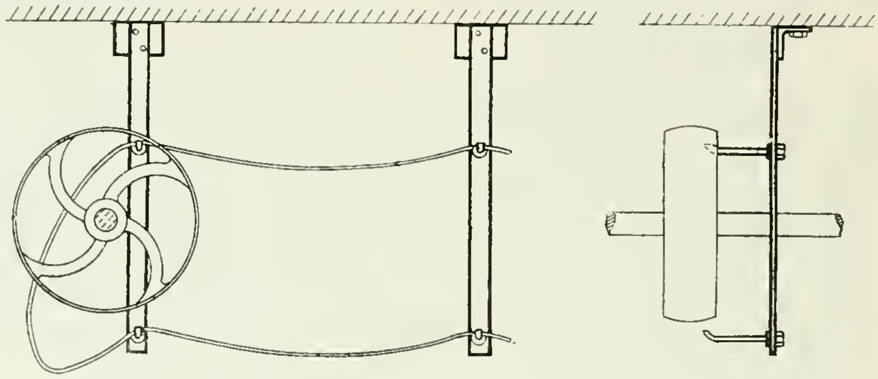


FIG. 17. BELT PERCH FOR HORIZONTAL BELTS.

A better type, where belt-poles are used to replace belts, is shown in Fig. 18. This consists of four or more parallel pegs with turned-up ends, bolted to a curved bracket fixed eccentrically near the pulley.

Dominion Steel Output.—The following are the figures of production by the Dominion Steel Co. and Dominion Coal Co. for the month of April:—Pig iron, 20,971; steel ingots, 26,444; rails, 14,601; rods, 3,021; bars, 2,238; other products, 4,258. These figures are approximately 60 per cent. of last year's output. The coal mined for the month is 408,931, against 437,133 in 1913.

SYSTEMATIC BUSINESS MANAGEMENT

Practical Articles for Managers, Superintendents, and Foremen, to Assist in Carrying on the Business Economically and Efficiently.

INDUSTRIAL LIFE CALLS FOR TRAINING.

DOES not formal education as organized aud controlled by the State stop short for a very large proportion of the youth at too early a period? Should the State organize and support vocational education? If so, what form should such education take?

These were the questions Dr. F. W. Merchant, M.A., sought to answer in his address before the College and High School Department of the O. E. A. recently.

The first question was proposed, the speaker said, because it was taken for granted that every child in the Province was receiving a fair common school education, and that for the great body of the people such an education was sufficient. While a few may be given a high school course, and a still smaller number be provided with university or professional training, the speaker questioned whether the duty of the State towards the child was not regarded as ceasing with making provision for a public school education.

Training That is Absent.

There can never be a permanent system of technical education which is not built on the solid foundation of a thorough elementary training. Managers of leading industries through the Province declare that a better elementary English and mathematical education is required. A large proportion of those entering industries are receiving no instruction in either theoretical or practical departments of their trades in State-supported schools.

Specialization in manufacture has made it almost impossible for a youth to acquire the elements of a trade in a shop or factory. There are at the present time no adequately organized agencies to give the youth a training in trade or in the elements of technology. Labor and capital are agreed upon the need of such a training.

Modern life has not yet accommodated itself to the great revolution of our industrial system. We believe that the education of workers is a public necessity, and that it should not be a private but a public function, conducted by the public, and the expense involved at public cost.

With regard to plans for such a training the speaker was of the opinion that every public school should be a pre-vocational school in the sense that pupils will find in it opportunities for discovering their aptitudes and will receive through it such a grounding in the elements of a general education that they will be in a position to take fuller advantage of a later course in more direct preparation for their vocations.

The speaker described the technical system as it works in European countries, where in a good many instances there was compulsory training. This he declared to be necessary to introduce into the country.

RELATION OF EMPLOYERS TO TECHNICAL AND INDUSTRIAL EDUCATION.

EVERYONE who has studied the subject, said Henry V. Gunmere, at a recent conference, knows the intimate relation between the industrial standing of any country and the knowledge and the efficiency of those engaged in its industries. While this relation holds for all, from the humblest unskilled operative up to the corporation manager, it seems especially important to have those in the lower places realize it, since their educational opportunities are certain to have been the more limited.

Thousands of boys leave school yearly from the lower grades to go to work. To most of these will come later a keen realization of lost opportunities and the absolute necessity of making up for them, for they enter commercial or industrial occupations utterly unfitted for advancement to higher positions. What they can do, how well their capabilities can be developed, will in most cases depend on what possibilities their employer brings to their attention and makes available. Most employers are well aware of this and try to help those who work for them to find ways of gaining the knowledge they need. Experience has shown that as a purely business proposition this pays. A young fellow whose character and habits of life are known, whose personality and ability have been tried out, is usually much to be preferred to any stranger when appointments are made to positions of large responsibility.

Educational Problems to be Studied.

The scope of this article does not permit more than a passing word regarding the various educational agencies which have been made use of for the purpose of training men for advancement. Its main purpose is to point out some of the many educational problems which must be studied in order to decide upon the best plan of procedure in any given case.

Associations or clubs, whether local or branches of a national body, which meet periodically to hear an address or participate in a discussion are at best educational only in a supplementary way. Any study done in connection with them is not consecutive and usually to be beneficial needs a foundation which is too often lacking. The corporation school is rather new, and for every corporation large enough to organize and conduct one, has interesting possibilities; the tendency, however, is always to train for immediate usefulness in detail rather than in broad principles, while the variety of courses which can be offered is bound to be small. If, for example, the school is organized to benefit the workers in the shop, what shall be done with those in the business office who need an entirely different training?

A correspondence school, either within the corporation or outside its control, offers the only means of systematic study for those residing at considerable distance from the large centres of population, or where the number of persons interested in a given kind of work is too few to warrant the formation of a regular class. When schools can be reached where experienced teachers are in charge, where direct recitation methods are used, and where a variety of courses can be offered in a systematic way, the establishment of regular classes in off-duty hours offers the best method of giving the desired instruction. These usually take the form of night schools or evening classes.

Night schools have flourished in the last twenty years wherever established. Their advantages are fully recognized by those who have been attending them. Such are:—Immediate help over difficulties, procured by having an instructor at hand; the opportunity to learn by the mistakes of others in the class; compulsory regularity in study, so important even to a very earnest student; the stimulus of numbers; the desire to stand well in his class; the possibility of drill; and many others.

Such school work, offered not only in the evening, but in the late afternoon as well is likely to have a remarkable growth in the future. To the general public the work which is being done as regards both scope and quality remains

practically an unknown quantity at the present time. Employers are just waking up to what has been and can be done in this way. No matter what educational agency is used, a number of problems arise which can be solved only by the co-operation of employers, employees, and teachers.

What courses are needed? How much time can be required of busy men for school work? What fees are suitable? How shall those be accommodated who have long distances to travel and high earfares to pay? Should classes be established in locations remote from the schools, in shops or in offices, but under the control of their trained faculties? These are some of the problems which have never been fully answered. The answers would probably differ with a change in locality.

Other questions are almost wholly the concern of the employer; such as—What school and what kind of education can best help my employees to gain what I want them to know? Which of them can profit most by systematic school work? How can I help them to get it?

The only satisfactory way to reach a conclusion on these matters is to have some common meeting ground for all interests where free discussion can have full play. In Philadelphia steps to this end have already been taken. Last spring representatives of the Central Educational Institute of the Y.M.C.A., Drexel Institute, the Franklin Institute, School of Industrial Arts, Spring Garden Institute, Temple University, and the Wagner Free Institute of Science joined with representatives of the Philadelphia Trade Schools, and the Philadelphia and Camden Public Schools in arranging meetings for the purpose of becoming acquainted with one another's work and the educational problems employers have to face.

Wishing to avail themselves of the wide resources of the Public Education Association of Philadelphia, members of the faculties of the participating institutions are now organizing a section of that association to be known as the Industrial and Technical Education Conference of the Public Education Association. The membership is to consist of educators and employers, and the purpose is to seek earnestly the solution of the problems arising from the needs of the vast numbers of young people who have never had proper opportunities for securing that knowledge which will pave the way to better service and higher responsibilities.

It is hoped that the movement thus started will spread to include not only local representatives, but all those employers whose employees find in the large city opportunities which cannot be offered nearer. This means extending the work to a great many miles from Philadelphia, for classes could easily be arranged outside the city, managed by experienced teachers who are specialists in any given line of instruction.

SELF-ASSERTION.

By J. E. Cooley.

ARE you one of those who believe that the day of getting a foothold, prospering unaided and alone by one's own individual efforts, has passed away? Are you one of those who believe the day of making millionaires is no longer possible? Are you one of those who think opportunity knocks but once on the outside of each man's gate, and then throws him down for the rest of his days?

Opportunity, wealth, the power to rise and win, are to-day within the reach and grasp of every breathing human individual. It will ever be so upon this rolling, bowling planet. It is in the power of every human being to become great—to become wealthy—to fill the years with usefulness, and leave behind them vast areas of constructive works; peopled with living, breathing, hustling, human souls.

Do you know what keeps this great ball—7,913 miles in diameter, 24,859 miles in circumference—in motion? Do you know what causes the sun to shine and send its rays, 91,430,220 miles in length, down to us?

It's force—universal force. Vesuvius eruptions are belched forth by it. Earth's oceans' caverns were dug by its unrelenting power. Youve got it in your little finger, in your biceps, in your spinal cord, in the base of your brain; it runs the power plant of your anatomy. It's the great energizing fluid that carries men over the brink of destruction or upward to the heights of fame.

Do you want to rise? Do you want to go forward where others dare not climb? Do you want to find other worlds to conquer—be a man above men—have your name go ringing across the ages; a name that will outlast tombs and tablets of bronze. Then be a doer, a mover, a constructor. Lead, don't follow. Summon all the strength within. Go forth and take your rightful place in the universe; be a constructor, be a changer, be an improver. Count the things around you that need changing, count the things that need improving, count the things that should be cast aside, and have new things installed in their places, and be the one to change, improve and install.

Bring out of yourself each day all the force you can squeeze from bone and sinew; from cord and ligament, and put that force into active, progressive service; the service that builds more factories, enlarges plants, erects more smoke-stacks, that counts at each stroke of the clock from sunrise to sunset; service that makes better the condition of your fellow-men.

Would you abolish disease, poverty and crime? Would you build cities, with paved streets and healthy sanitary homes—within them glowing firesides surrounded by happy smiling faces? Fellow-man, that is in your power. It is in your power to recreate yourself, to become energized, and build greater than ever man built before.

For millions of years this universal force has been calling to mankind to build and make better the conditions on this earth. It has been calling, with the noise of whirling planets, of earth's eruptions and crashing glaciers. It is asking you, sir, to do to-day the things it asked of old. It is saying not until you do them will you be crowned with "immortal glory" and clad in "raiment of light." The things that it wants done are the things at hand. Wherever you find yourself, the universe placed you there; and right at hand where it placed you it has placed the things it wants done, and it expects you to do them.

CANADA'S TRADE WITH GERMANY.

CANADA'S increasing trade with Germany and the desirability of having that country as a Canadian customer are pointed out in an article in the Weekly Report of recent issue by Mr. G. F. Just, the Canadian Trade Commissioner at Hamburg. Canada is now in the unique position, says the article, of exporting more to Germany than she is importing from that country. The exports of wheat to Germany during 1913 were 50,000 tons above those of 1912, which were two and a half times as much as in 1911.

Again, this year it is expected that Canada will have exported more than was imported from the German Empire. Canadian wheat, barley, and oats enter Germany at the same rate of duty as do the same products from other countries, but in agricultural products, of which Germany imports large quantities, all competing countries enjoy a lower tariff than is afforded Canada. Conspicuous among these is flax, of which Germany imports $42,000,000 worth, chiefly from the Argentine Republic.

The Canadian Minister of Agriculture has decided to reorganize the Dairy and Cold Storage Department, separating from same the fruit section and creating a new Fruit Division. Daniel Johnson, of Forest, Ont., has been appointed fruit commissioner. J. A. Ruddick will continue in charge of the Dairy and Cold Storage Division.

MACHINE SHOP METHODS AND DEVICES

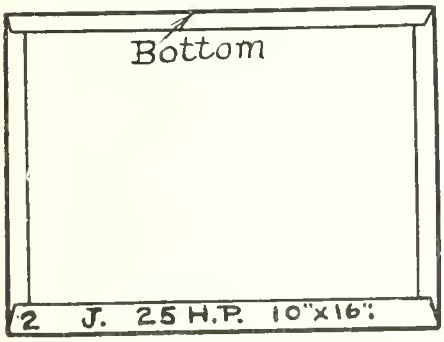
Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

A DRAFTING ROOM SYSTEM.

By D. O. Barrett.

THE writer at one time had charge of the drafting room of a firm building gas and gasoline engines and their accessories. This firm manufactured a variety of sizes and employed about 225 men. The original system of filing drawings had been a separate drawer devoted to each size of engine, and the consequence was that the filing cabinets occupied most of the space in the drafting room, and when a blue print was to be located it was necessary to sort over a confused jumble of tracings and prints of all sizes, the drawers, of course, being made large enough to accommodate the largest tracings. This system caused so much confusion and loss of time that the following method was adopted.

The bottoms of five of the drawers in one of the old cabinets were removed



A DRAFTING ROOM SYSTEM.

and six of the frames fastened solidly together, thus making one deep drawer. Partitions were then put in on either side, corresponding to the width of the drawings that were to be used. These partitions were grooved every half-inch with a saw cut, and a piece of 16 gauge sheet metal used as a back; this could easily be slipped along as occasion required.

Standard size drawings were 17 in. by 22 in., or in case of large sizes, some multiple which could easily be folded to this size. Envelopes were now made from the heaviest grade of manila paper, these being about 18 in. by 24 in., being left open at the top, or along the 24 in. dimension. By folding back the open edges about twice, and gluing, these envelopes will resist a great amount of handling without tearing and will last for many months, especially so as it is seldom necessary to remove them from the filing case. A further reinforcement was glued along the bottom, the edge on which they rested. These were fyled vertically, of course, the same as in the card index.

The drawing shows the manner in which the envelopes were made, and the style of title printed on the open edge of each. When these envelopes were placed in the files, the titles came at the back, but the top of the filing drawer was about waist high, so that as the envelopes were pulled forward in sorting over, the titles could be easily read, and were the envelope laid out on a table, the titles remained on top. At the left edge was placed the number of the envelope in the filing case. These envelopes, carrying engine prints were filed first according to sizes of engines, and after them came any other prints. The symbol of the engine was next, and then the horse-power; after this also being placed the bore and stroke of the engine, so that all the information covering the prints in that particular envelope were given on its face.

It was often necessary for the machine shop foreman or his assistant to come into the drafting room and pick out prints themselves so that it was very essential to have the system as simple and practical as possible, and after long-continued use its success was borne out. An index was also provided giving the number of the fyle and the material contained in the envelope, together with its horse-power and symbol, by which they could be easily located.

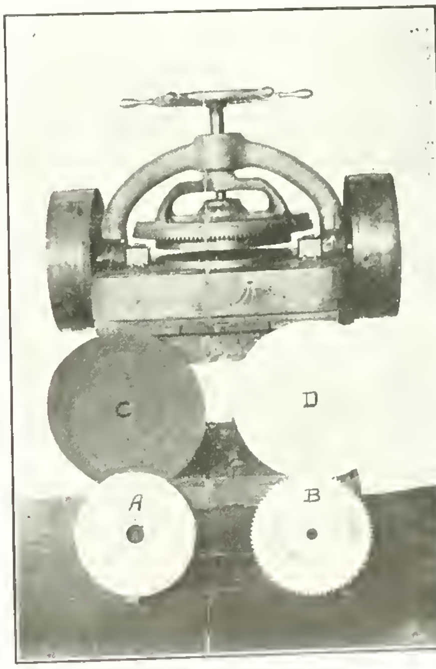
The original drawings were made on tracing paper, which was much cheaper than tracing cloth, and when handled with a reasonable amount of care would last indefinitely. These drawings were fyled in the office vaults in the same size envelopes as used for the prints. One print from each drawing was always on file in the drafting room, and more in case the prints were often used. Drawings bore the same number and symbols as the parts themselves, so it was easy to locate them after having the part symbol.

PEINING, GRINDING AND POLISHING MACHINE.

By A. E. S.

THERE is here described an interchangeable peining, grinding and polishing machine designed by Wm. Gibbs, of Brantford, and which is in use at the plant of the Verity Plow Co. of that city. Its purpose is the straightening and polishing of metal disks and the polishing of sheets of any material in widths up to 18 in. and in thicknesses of 4 in. and under.

The machine has a heavy frame and base plate, as shown in the illustration. There are two horizontal revolving disk plates, the lower one being stationary and the upper one adjustable up and down by means of a powerful screw. The drive consists of two pulleys driven from a shaft by means of one straight and one crossed belt. Each pulley has keyed to the same shaft with it a rawhide bevel pinion, which meshes with the gears attached to each disk, giving them a double drive in opposite directions. The top disk can be lifted out of mesh at will, while the bottom one runs continually.



PEINING, GRINDING AND POLISHING MACHINE.

The peining disks consist of flat hardened plates, 18 in. in diameter, and carrying 250 hardened balls, no two of which revolve in the same circle. The pieces to be straightened and polished, such as the seeding machine disk A or the saw disk B are placed upon a spring pin which locates them centrally with the bottom plate. The top plate is screwed down upon it with sufficient pressure to cause the balls rolling on both sides of the disk to work the surfaces of the metal into a condition of uniform tension. The effect is that the disks come out after ten minutes' treatment perfectly flat and straight.

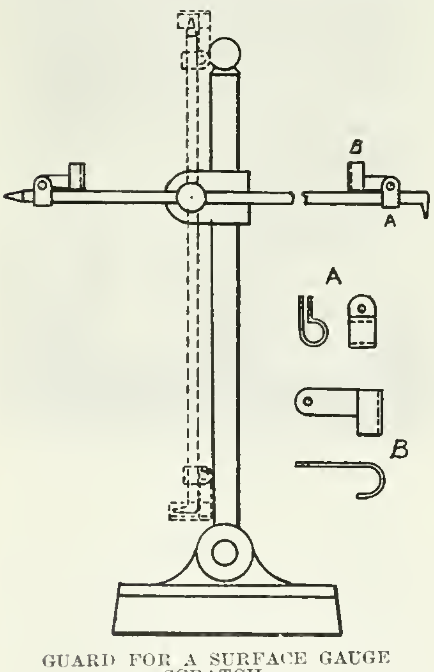
The peining plates can now be removed and grinding plates C substituted. This requires the removal and replacing of two cap screws in each, and takes about ten minutes to accomplish. The machine is speeded up from 18 to 22 for peining to from 200 to 400 r.p.m. for grinding and polishing. The straightened disks are polished in the same way as the peining was done except that but a slight pressure, and ten seconds are required for the operation of finishing both sides.

While specially designed for the above purpose, the machine is equally serviceable for sizing and polishing metal and wood sheets of any kind within its capacity, the different thicknesses of stock being accommodated by disks of the requisite thickness to mesh the gears properly. For polishing wood, sanding disks D are used, and the material is fed between the revolving plates in the same way as through a planing machine.

GUARDS FOR A SURFACE-GAUGE SCRATCH.

By James E. Cooley.

WHEN taking from a tool-chest a surface-gauge, carrying it to the work, setting it up and handling it in the several ways necessary in using it, the workman receives a number of "punctures" in his hands from the sharp-



GUARD FOR A SURFACE GAUGE SCRATCH.

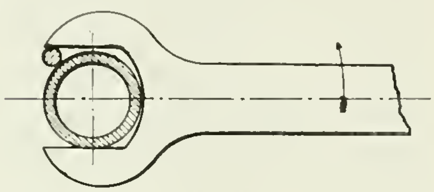
pointed scratch contained thereon. These little punctures neglected develop often into other things more serious.

In the accompanying sketch is shown a small guard that when placed on the ends of a "scratch" will prevent the hands from coming into contact with the sharp points, and which cannot be lost off. It consists of a small ring clip (A), made from sheet steel and tempered, and fitting snugly on the scratch. A small arm (B), also made of sheet steel, is fastened on the clip (A) by means of a pin on which it swings to cover the pointed ends. When it is required to use the scratch, the arm (B) can be swung up out of the way; but, when the points are not in use, the arm should be kept down. All pointed instruments should have guards of some kind placed on them.

USEFUL WRENCH KINK.

By G. G. Jackson.

THE sketch shows a simple and effective method of turning a piece of pipe or other round material with an ordinary solid wrench. This is not a new



USEFUL WRENCH KINK

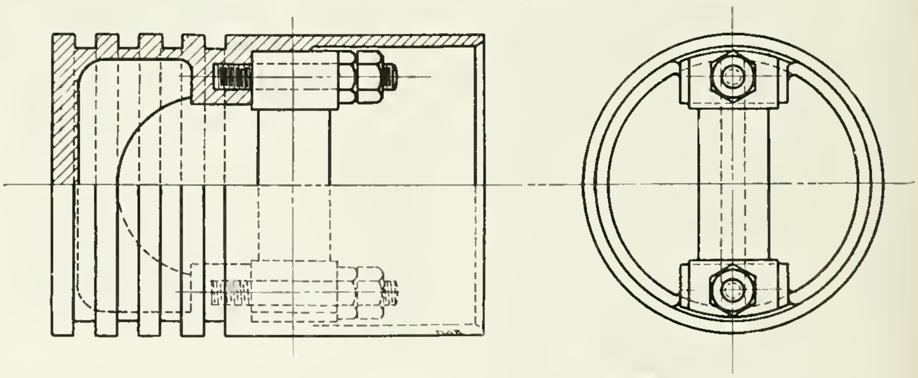
wrinkle by any means, but it will save a great many steps when a pipe wrench is not at hand. Simply place a piece of a small round file between the pipe and wrench as shown and turn in the direction that will tend to jam it in more tightly as the power is applied.

The scheme will not work satisfactorily unless the jaws of the wrench are fairly new and square.

A NOVEL TYPE OF PISTON PIN.

By D. O. Barrett.

AN American firm building gas tractors of the twin cylinder horizontal type use a rather novel type of piston



NOVEL TYPE OF PISTON PIN.

pin in their construction. The piston and pin are shown in the accompanying drawing. When the open end of the piston is bored, the bosses are faced off, and the shoulders bored to the proper dimensions at the same time. The pin is made of square steel, the central portion being turned to fit the bearing in the connecting rod. It is also turned on the ends, accurately fitting the boring which was previously done in the piston; this centres the pin accurately in both directions. The pin is held in the piston by means of a large stud on either side. Whenever it is desired to adjust the bearing on the engine, this is done without removing the piston from the cylinder. The nuts are removed from the piston pin studs, the pin slipped out of the piston, and the proper adjustments made on the rod. The pin is then slipped back into place, and the studs tightened.

This type of construction, while perhaps not indorsed by many designers, simplifies piston construction to a certain extent. The troublesome job of cross boring which must always be done in a separate operation, either on the drill press or the lathe, is dispensed with. Since the machining for the piston pin is done at the same time as the boring of the open end, it is an easy matter to use a turned plug fitting in the piston for holding same when turning the outside. This supports the piston for half its length and prevents a great deal of distortion at the centre.

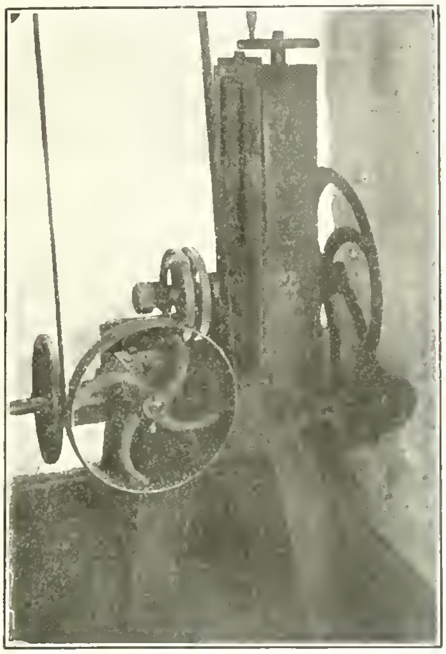
AN OLD GEAR CUTTER.

By A. L. Loy.

THE writer recently ran across a gear-cutter, shown in the accompanying photo, in a gas engine plant. According to a statement made by an employee who had been with the company thirty-five years, the age of this cutter was somewhere between fifty and sixty years, and as will be noticed in the illustration, it is still used for gear cutting. While the machine may look a little antiquated, a careful study will show that its construction and method of operation is exactly similar to many of the latest automatic cutting-machines on the market.

The machine is not equipped with a power feed, although this could be very easily done. The hand-wheel seen at the left feeds the cutter back and forth. The

gear blanks are carried on the horizontal shaft, on the outer end of which is a large worm gear. The worm shaft is arranged for a set of spur gears to which is connected the indexing handle, at the opposite side of the machine. The proper gears are used so that the indexing handle may be turned through one revolution for each tooth to be cut. The indexing handle is attached to a rectangular bar, which is held in a corresponding notch by means of a spring. In indexing, this handle is pulled out and turned one revolution; the proper depth of cut being obtained by means of the hand wheel at the top. No outer support is provided for the blanks, although this could easily have been done. It is surprising, considering the age of this machine, that the work being turned out is of such a creditable nature.



AN OLD GEAR CUTTER.

Suction Device.—A small magnet on a long handle is an excellent thing to have about a motor repair shop for lifting small nuts, bolts, etc., out of obscure places. It is open to the objection, however, that it will serve only for iron or steel articles. To overcome this objection there has just been placed upon the market a somewhat similar device in which suction takes the place of magnetism. The lifter consists of a rubber suction cups at the end of a handle, which is hollow and which is connected to the hose leading to an exhaust pump. A small thumb valve affords control, and there is a hook for dislodging small articles. The device is intended primarily to lift sheet metal stampings from under die presses, but it is useful in many other ways.

DOING IT YOURSELF.

THE individuals whose lives are really valuable never asked anyone how to make them so. This is a great truth, but it has its danger. The truth in it is self-reliance and the danger is the neglect of experience. It is almost certain that no successful man ever owed his success to any book, written probably by an unsuccessful author, and entitled "How to Succeed."

The successful man as a rule maps out his own course and moves along it toward his goal by his own self-reliance. What experience of others he can get along the way he is willing to consider carefully and to weave it into his own fabric, if it seem to him to have a place there, but on the whole he is not a great asker of advice. He knows almost instinctively that sooner or later he has to take his own advice, and he knows that whatever has to be done he has to do it himself. The people who are for ever asking the advice of others and looking elsewhere than in themselves for the key of success are not very successful till they have discovered their mistake, and have set about doing the thing themselves. This is the Parable of the Talents over again.

What is this "iron string" within every successful man that vibrates only to this masterful touch? The strength of your life is measured by the strength of your will, but the strength of your will is just the strength of the wish that lies behind it. Is this wish some little personal pleasure that extends over a day or over a week and is gone, or is it a good will that runs over a lifetime and has a man behind it?

NEW STEEL CAR SHOPS.

(Continued from Page 473.)

the car, where the rivets are small and small errors in the location of the rivet holes are relatively serious. It is intended to handle the drilling of the long side members of the car in the same way as that of the side sheets. The drilling of the small side cover plates will also be handled on a jig by a small sensitive drill, and it is intended to use rollers and stops in order to minimize the cost as far as possible.

Assembling.

The same arrangement of an assembling jig is used in the passenger shop as was adopted in the freight, but the number of operations has been reduced to one: and the assembling, reaming and riveting of the underframe is done in one position. On account of the much greater length of the jig and the fact that the wall of the shop adjacent is considered as a temporary wall, in view of the probable extension of the shop, it was impossible to use a jib crane of any type because of the head room that it would require. A low crane runway was, therefore, adopted, with small traveling cranes to carry the riveters. With this arrangement the number of riveters needed can be increased indefinitely in proportion to the output of underframes required, which certainly could not be done in the case of jib cranes. It further enables the underframe to be lifted out in either direction. The underframe jig is located centrally in the shop in view of the probable future extension.

Erecting.

The noticeable feature of the erecting portion of the passenger shop is the arrangement of small bays running lengthwise over each track, the small traveling cranes just large enough to handle material or riveters as required, and a unique arrangement of scaffold posts short on one side so that the cranes can operate over them, but stiff enough to carry rivet furnaces for the roof work, men's tools, etc., or to serve for a backing for light drilling work on the side sheets or framing.

Special rivet furnaces are used for the heating of rivets to prevent the pitting so common in the ordinary oil furnaces. These muffle furnaces have given very good satisfaction, and while they are slow in heating up, burning of rivets and pitting is very materially reduced. In the passenger sections there are two positions on each track and four tracks. The output in the original lay-out of the shop was based on a 10-car output per month. It was thought that each car would stand ten days in each position and that the underframe would turn out a car for every two and one-half working days, but it is evident from the progress already made that a better output than this will readily be obtained.

In the first position the posts, end frame and complete frame work of the car are erected and side roof sheets and hood sheets are applied. As the car leaves the first position it is run on by the second position outside the shop, where it is sand blasted and then returned to the second position for finishing. In the second position the centre roof sheets and flooring, including vestibule trimmings, etc., are applied. The car is then sent over to the wood passenger shop for inside trimming and finishing. A transfer table is provided at the outside of the shop for switching the cars from track to track or to the outgoing track, and the sand blasting at the present time is done outside the shop between the shop and the transfer table.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

With the further development of this course in arithmetic, it will be found by those who have followed the introductory lessons and profited by them that the various practical applications resulting from the succeeding lessons will be easily observed and their time and labor-saving features so appreciated as to be adopted at every available opportunity.

In our April 23 issue the elements of trigonometry were discussed, and the different functions featured in diagrammatic and tabular form. The present lesson is a continuation of the foregoing, and deals principally with the practical application of the subject.

Example:—Required the sine of an angle of 36° 45′. From table, Chart 15, a° = 36°.

Sine of a° or 36° = .58779
Sine of a° +1° or 37° = .60182

d = .01403

Then by formula,

$$f_1 = f \pm \left\{ \frac{m}{60} \times d \right\} = .58779 + \left\{ \frac{45}{60} \times \frac{.01403}{1} \right\} = .58779 + .01052$$

= .59831 = Sine of 36° 45′

Example:—Required the cosine of the angle 65° 36′.

f = cosine of a° or 65° = .42262
f of a° + 1 = cosine of 66° = .40674

d = .01588

Then by formula,

$$f_1 = f \pm \left\{ \frac{m}{60} \times d \right\} = .42262$$

$$= \left\{ \frac{36}{60} \times \frac{.01588}{1} \right\} = 42262 — .00953$$

= .41309 = cosine of angle of 65° 36′

Again:—Required the angle whose tangent is 2.82436.

$a°_1$ = required angle.

Looking in table, we find that this number falls between the angles 70° and 71°, then

tangent of a° or 70° = 2.74748
tangent of a° + 1° or 71° = 2.90421

d = 15673
d_1 = 2.82436 — 2.74748 = .07688

By formula,

$$a°_1 = a° + \left\{ \frac{d_1}{d} \times 60 \right\} \text{min.} =$$

$$70° + \left\{ \frac{.07688}{15673} \times \frac{60}{1} \right\} \text{min.} = 70° \ 30' \text{ nearly.}$$

Practical Application.

Charts 16 and 17 show the practical application of trigonometry to some of the problems of everyday work.

A blank is required from which a hexagon is to be milled, to measure 8 inches across the flats. (Chart 16).

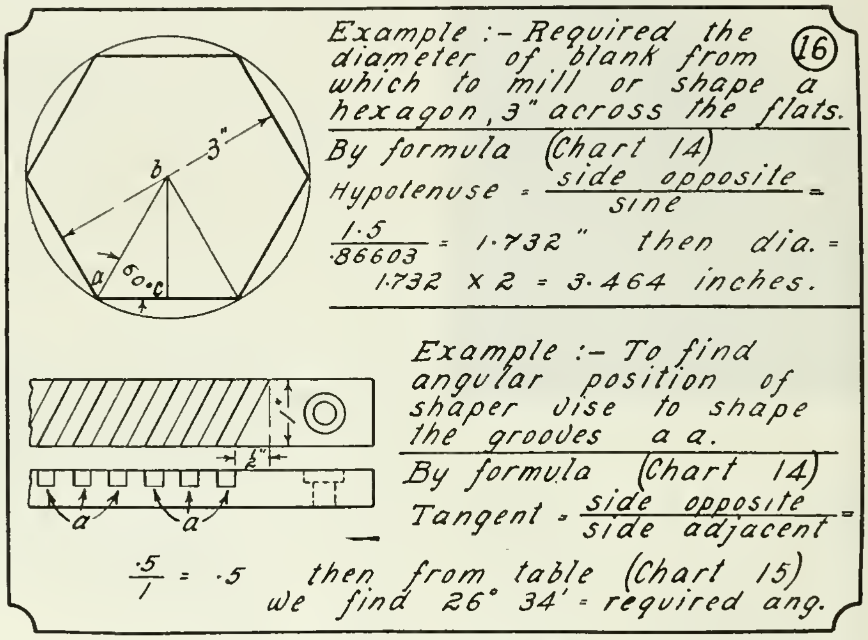
Angle (bac) = 60°;

length (b.c.) = 8 ins. ÷ 2 = 4 ins.; then hypotenuse or length (a b) =

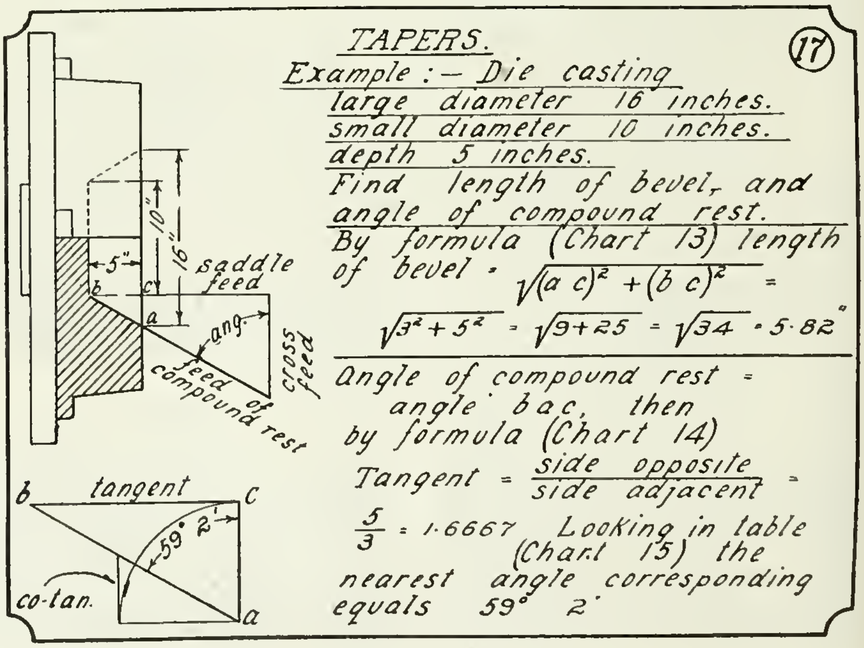
$$\frac{\text{side opposite}}{\text{sine}} = \frac{4}{.86603} = 4.62 \text{ inches.}$$

Diameter of blank = 4.62 × 2 = 9.24 inches.

In a bar 1½ inches wide and similar



ARITHMETIC CHART 16.



ARITHMETIC CHART 17.

to that shown in Chart 16, a number of grooves are to be cut, the advance of one side over the other being $\frac{5}{8}$ inch. Required the angular position of vise to shape the grooves.

In this case, the two sides of the right triangle are known; then from formula, Chart 14, we have

$$\text{tangent} = \frac{\text{side opposite}}{\text{side adjacent}} = \frac{.625}{1.5} = .41667$$

Looking in table, Chart 15, we find this number lies between 22° and 23°.

For closer calculation we use the formula at foot of the table:

$$a°_1 = a° + \left[\frac{d_1}{d} \times 60\right] \text{min.}$$

$$d = .41667 - .40403 = .01264$$
$$d_1 = .42447 - .41667 = .00780,$$

then.

$$a°_1 = 22° + \left[\frac{.00780}{.01264} \times \frac{60}{1}\right] \text{min.} = 22°\ 37'.$$

Again, a die casting, similar to that shown in Chart 17, is to be turned to have a depth of 6 inches, large diameter 15 inches, small diameter 10 inches. What is the angular position of compound rest?

In the right triangle (a c b), we know the dimensions of the two shorter sides, that is 6 inches and (15-10) ÷ 2 = 2.5 ins.

Angle required = (b a c)

Then by formula, Chart 14, we have

$$\text{tangent} = \frac{\text{side opposite}}{\text{side adjacent}} = \frac{6}{2.5} = 2.40000$$

Looking in table we find this number to be between 67° and 68°.

By formula, Chart 15,

$$a°_1 = a° + \left[\frac{d_1}{d} \times 60\right] \text{min.} =$$

$$a° + \left[\frac{.04415}{.11924} \times \frac{60}{1}\right] = 67°\ 22'.$$

THE LENNOX THROATLESS ROTARY SHEAR.

A UNIQUE type of shear, designed for straight, serpentine, and irregular cutting of sheet metal is being made by the Canadian Lennox Throatless Shear Co., Toronto, Ont. One of the most noticeable features of this machine is the absence of the "throat" section, which makes it possible to handle plates or sheets, regardless of length or width.

The accompanying illustration shows the general design of the shear, and the novel shape of the frame will be noted. The frame is designed in the form of a helix, so that it allows the plate, while being cut, to separate naturally—one side to the left-hand moving freely in a horizontal direction, while the right-hand part moves in a downward direction. Another prominent feature is the wide range of irregular cutting that can be done. Any irregular line can be easily followed, or swinging from one curve to another, either right or left, or in a straight line. Circles and reverse curves are, it is claimed, executed rapidly, while a perfectly smooth edge results. It is also claimed for this shear that in doing irregular work, 75 per cent. can be saved in cutting costs compared with hand and old-style power shears, besides producing much better work.

The cutting is done by two rotary cutters made of high-grade tool steel. The upper cutter is positively driven, and is slightly knurled on one face, to feed the metal, while the lower cutter shaft is housed in an adjustable sleeve and runs free. Adjustment of cutter is made in this sleeve to suit the different thickness of the stock, or for the slight reduction in cutters after regrinding. The shear is simple in construction and is easy to operate, being also rigid and compact, that illustrated being 60 in. high, and weighing 650 pounds. The head is a solid steel casting, while the base is made of cast iron and occupies a floor space of 26 inches square. The gears are of steel and iron cut from solid blanks, and guarded. The machine is equipped with a clutch pulley 12 in. in diameter and of 3-in. face, dispensing with the need of a countershaft.

The shear illustrated will cut No. 10 gauge steel plate and lighter stock with a limit of $4\frac{1}{2}$ in. radius. Other sizes are being put on the market, and these will have cutting capacities for $\frac{1}{4}$-in., $\frac{3}{8}$-in. and $\frac{1}{2}$-in. steel plates respectively.

"LENNOX" THROATLESS ROTARY SHEAR.

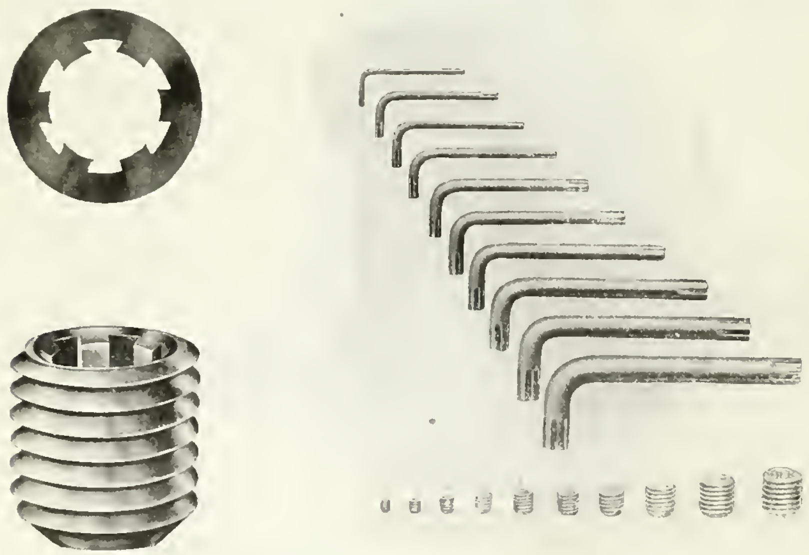
DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

NEW PATENTED SAFETY SET-SCREWS.

THE Bristol Company, Waterbury, Conn., has recently put on the market a new and improved line of "BRISTO" Patented Safety Set-screws as shown in the accompanying illustration. These are manufactured under the Goodwin patent of October 14, 1913, and the patented design is shown in the cross section, from which it may be seen that there are six dove-tailed slots inside the hollow head of the set-screws, and six corresponding flutes on the outside of the special wrenches used with these. The dovetailed design is such that when the set-screws are set up hard with the special wrench, the latter gives the screw a true rotary motion without the usual tendency to expand and crack the hollow head. The angles of the surfaces of the slots are such that there is just a tendency for the wrench to contract or compress the head of the screw. The screws are manufactured in a great variety of sizes, a few of which are shown. A special treatment process is used which makes the screws glass hard on the outside and extremely tough on the inside, and samples have been found in actual test to be 100 per cent. stronger than the old hexagon style set-screws.

The "Safety First" movement has progressed so far that great attention is now being given to changing the design of machinery to protect human life and the elimination of the old style set-screws with projecting heads is one of the things on which safety engineers and insurance inspectors insist. At the First International Exposition of Safety and Sanitation recently held in New York City, a silver medal was awarded the Bristol Co. for its exhibit of safety set-screws.



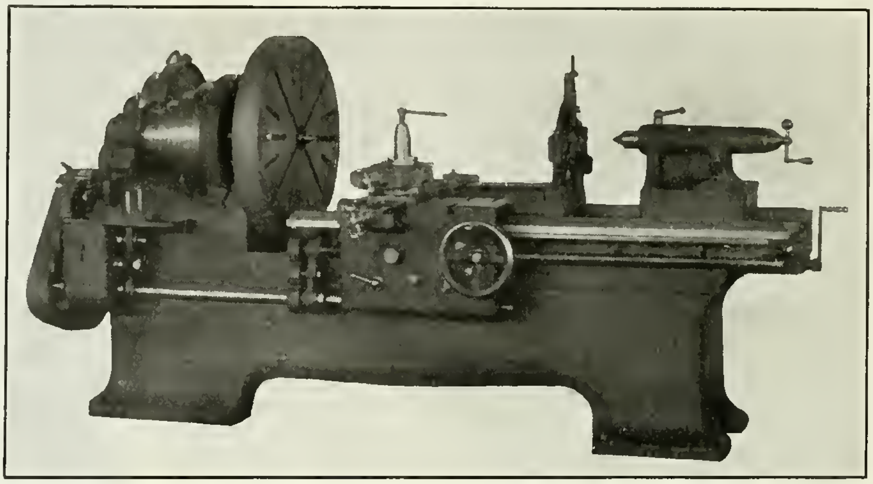
BRISTO PATENT SAFETY SET SCREWS AND WRENCHES.

HEAVY "BARNES" GAP LATHE.

THERE is being placed on the market by the Barnes Drill Co. of Rockford, Ill., a heavy sliding extension general purpose gap lathe with 22-36-in. swing and 8½-ft. bed. It has been particularly designed for general repair shop use and for some lines of manufacturing work requiring a lathe of large swing, but which would not warrant the expense of a standard 36-in. lathe.

Special attention has been given to strength, rigidity and power, as well as convenience, durability and accuracy commensurate with a wide range of work.

The main and sliding beds are planed and scraped together. They are unusually heavy and broad, and are braced so as to give the maximum strength and rigidity. The top bed is particularly wide (24⅞ in.), extending beyond the main bed so as to provide a support for the carriage when turning work of large diameter through the gap, the object being to do away with a special brace for this purpose.



HEAVY "BARNES" GAP LATHE.

The cone steps are of large diameter, and are designed for a 3-in. belt. The lathe is also powerfully back-geared, and the extension gap gives a capacity for a large variety of work.

The regular equipment furnished with the lathe consists of countershaft, steady rest, follow rest, large and small face plates, centres, wrenches, and full set of change gears. The weight with 8½-ft. bed is 5,300 lbs., and for every 2 ft. extra length of bed 600 lbs. additional.

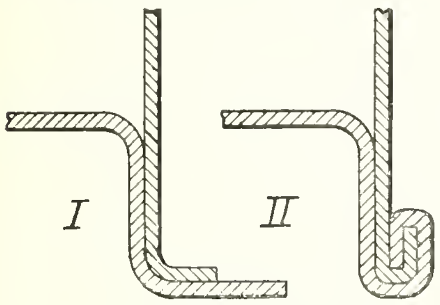
HEAVY NIAGARA DOUBLE SEAMER.

TO meet the increasing demand for heavy metal barrels and tanks with double seamed ends, the double seaming machine shown in the accompanying half-tone has been placed on the market by the Niagara Machine & Tool Works, Buffalo, N.Y.

Before the seaming operation takes place, the cylindrical bodies and ends have to be prepared as shown in Fig. 1—i.e., the bodies have to be flanged in a

flanging machine, while the disks have to be stamped with a depression and flange by means of press and dies. Fig. 2 shows a double seamed joint.

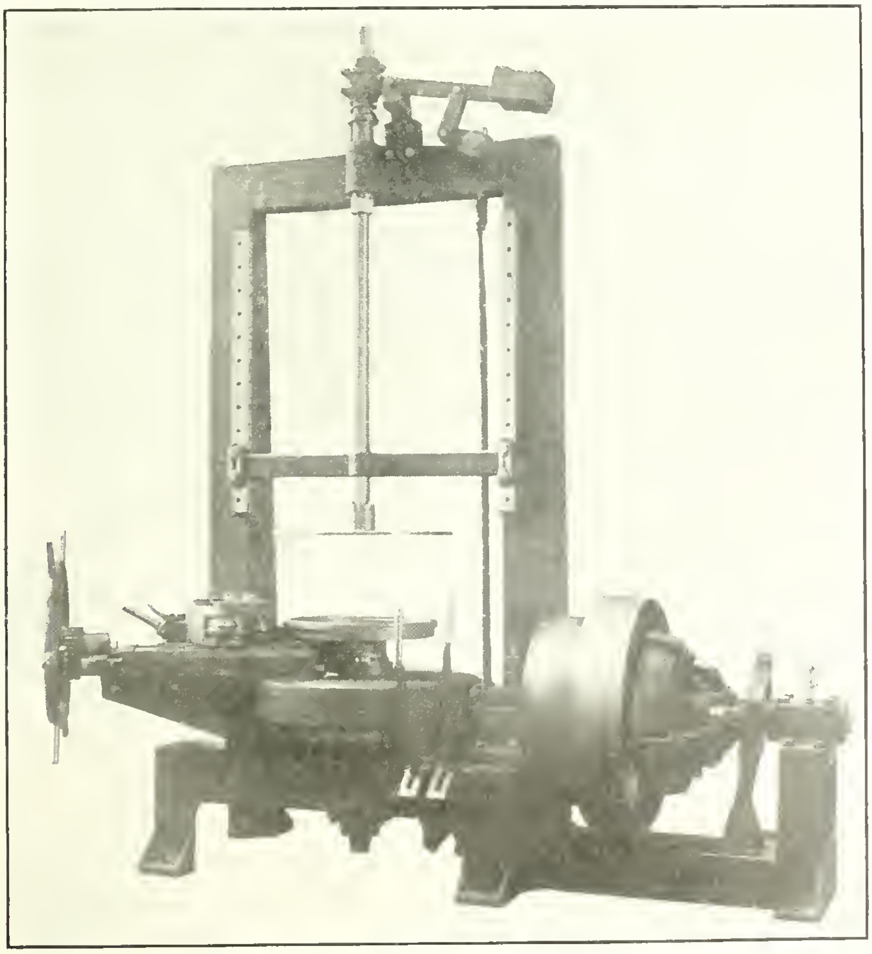
The machine is throughout of heavy and massive construction, and particular attention has been given to arranging the controlling levers most convenient for the operator, thus obtaining a



PROGRESS OF SEAMING.

maximum output. The vertical seaming chuck spindle is driven from the pulley shaft by means of a pair of bevel gears, and an adjustable end thrust bearing is provided for the vertical main shaft as well as for the top clamping plate. The latter can be adjusted for work of different height, and is raised and lowered by means of a hand lever actuating a pair of toggles.

A hand lever controls the motion of the machine by means of a friction clutch. The seaming roll turret is mounted on a slide, the latter being operated by means of a screw and hand wheel. Change gears are provided, giving the screw two different speeds. The machine will double seam material as heavy as No. 12 gauge, from 12 to 32 in. diameter and from 6 to 44 in. in height.



HEAVY NIAGARA DOUBLE SEAMER.

Handy Practical Data on Grillage Foundations

By H. Womersley

The officials of machine shops and foundries in contradistinction with the heads of other branches of industry, are expected to have at least a conversant knowledge of nearly every other trade. This handling of the above subject is intended to denude it of its usual cloud of theory and thus make it available for the man who must show practical results for all his time and exertions.

STEEL grillage foundations are now very generally adopted in cases where the load from a stanchion must be spread over a considerable area. For heavy loads or bad bottoms, the depth of a properly designed grillage foundation may be made very much less than is required for a solid concrete block, with the consequent large saving in cost of concrete, and of excavation. The nature of the soil where the foundation has to be built should be carefully examined, and if necessary, tested to determine the maximum safe load per square foot which may be applied. From this, and the total load to be carried, the required area of the foundation can be at once determined. After the ground has been excavated to the desired depth, and the surface approximately leveled up, a layer of at least 6 in. of good concrete should be laid; this is necessary to insure the regular spread or distribution of load over the whole area, and at the same time to present a level surface on which the lower tier of grillage beams may be set.

Weight of Joist per ft. in pounds	Dimensions in inches Depth	Width	Sectional Area	Distributed Safe Load Coefficient
4 to 5·5	3	1·5	1·17	5·52
8·5 " 10	3	3	2·50	12·6
9·5 " 13	4	3	2·79	18·8
10·5 " 14	5	3	3·23	27·2
18 " 22	5	4·5	5·29	45·4
19·5 " 23	6	4·5	5·88	57·7
23·5 " 27	6	5	7·35	72·7
18 " 23	8	4	5·29	69·6
26·5 " 30	8	5	8·24	117·7
32 " 38	8	6	10·29	138·2
28·5 " 33	10	5	8·82	145·7
40 " 47	10	6	12·36	211·6
51 " 57	12	6	15·88	213·0

PRACTICAL DATA ON GRILLAGE FOUNDATIONS.

Grillage beams should be spaced at least 3 in. apart between flanges (being held in position by means of separators and bolts); this clearance is necessary to enable the concrete to be efficiently packed in between the several joists. It is not necessary to paint the grillage joists if they are cleaned and reasonably free from scale as the cement will adhere better to the unpainted surfaces.

When all beams are in position and the columns set up, the whole of the steelwork should be protected with at least 6 in. of concrete to prevent rusting and deterioration. In the case of very heavy loads, it will sometimes be found necessary to consider carefully the shearing or buckling tendency in the webs of the grillage joists, but if these be efficiently supported by means of the concrete packing between and around them, the safe shearing or buckling value may sometimes be taken as high as one-half that of the crippling strength, with the addition of the support got directly from the concrete it-

self. Light column foundations can usually be formed with one or two tiers of joists; heavy columns may require three or even four tiers.

For a single column, the usual shape of foundation is square or oblong, but any shape may be adopted, so long as the column rests on the centre of gravity of the area. Where two or more columns rest on one block, they should be so placed that the resultant of the several loads shall coincide with the centre of gravity of the area. This is necessary to insure that the load is uniformly distributed over the whole surface of the foundation.

Grillage Calculations.

The calculations necessary to determine the size of grillage joists are very simple as the following formulae and sketch will show.

Equivalent safe distributed load on 1 ft. span $= 4\,psv^2$, where

W = Total load from stanchion in tons.

p = pressure per sq. ft. on area of any tier of joists in tons.

v = overhang of joist in any tier in feet. (B in sketch).

s = spacing of joists in any tier in feet (A in sketch).

The following example will explain the method of procedure.

Let total load W on stanchion = 350 tons, and let maximum safe bearing strength of soil = 2½ tons per sq. ft.; then required area for foundation

$$= \frac{350}{2\frac{1}{2}} = 140 \text{ sq. feet.}$$

Adopt grillage base 12 ft. × 12 ft., and base of stanchion as 3 ft. square.

Assume top tier 7 ft. × 3 ft., middle tier 12 ft. × 7 ft., and lower tier 12 ft. × 12 ft.

Values for the spacing (s) can be adopted so that the joists will work out in convenient sizes.

$$\text{1st tier, } P = \frac{350}{7 \times 3} = 16.67 \text{ tons;}$$

$$v = \frac{7-3}{2} = 2 \text{ ft.; } S = 9\tfrac{1}{2} \text{ in.}$$

$$\text{2nd tier, } P = \frac{350}{7 \times 12} = 4.16 \text{ tons;}$$

$$v = \frac{12-3}{2} = 4\tfrac{1}{2} \text{ ft.; } S = 11 \text{ in.}$$

$$\text{3rd tier, } P = \frac{350}{12 \times 12} = 2\tfrac{1}{2} \text{ tons.}$$

$$v = \frac{12-7}{2} = 2\tfrac{1}{2} \text{ ft.; } S = 12\tfrac{1}{2} \text{ in.}$$

Equivalent safe distributed load =

$$4 \times 16.67 \times \frac{9.5}{12} \times 2^2 = 211.$$

From the table for this value we get a beam 10 in. × 6 in. × 42 lbs. for first tier.

For second time we likewise get

$$4 \times 4.16 \times \frac{11}{12} \times 4.5^2 = 309, \text{ or a beam}$$

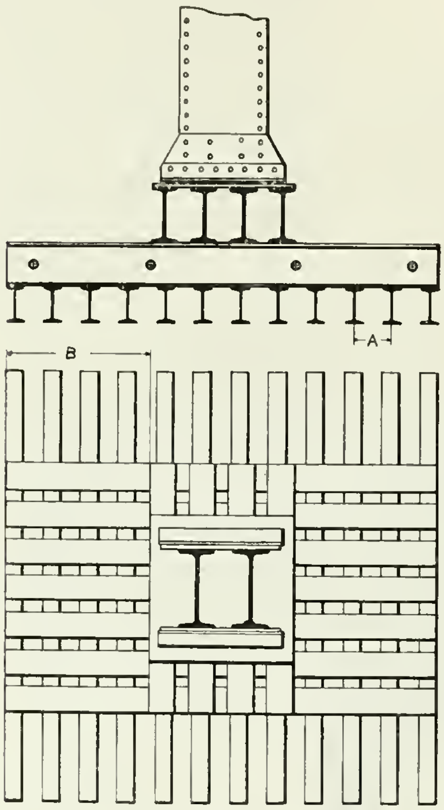
12 in. × 6 in. × 54 lbs.

For third tier, the size of beam is

$$4 \times 2.5 \times \frac{12.5}{12} \times 2.5^2 = 65$$

= 8 in. × 4 in. × 18 lb.

The above method of designing footings is simple and such that a contractor could adopt and obtain fairly reliable values without the help of a high-priced engineer.



PRACTICAL DATA ON GRILLAGE FOUNDATIONS.

POWER TRANSMISSION BY ROPES.

AN exhaustive paper on "The Transmission of Power by Ropes," was recently contributed to the "Proceedings" of the Textile Institute by Mr. Edwin Kenyon. After alluding to the conflicting experiments which have been carried out in Germany and the United States on rope transmission, the author said that with a well-designed installation in which good cotton ropes are used the index of centrifugal detraction might be safely removed a considerable distance beyond the 4,500 ft. velocity determined by the American tests. While it might not be advisable to push the proposition of constant power transmission by ropes to the utmost limit of mechanical endurance, which might mean a rim speed of 20,000 ft. or 30,000 ft. per minute for a properly made steel pulley, all the evidence obtainable from actual experience went to prove that we might safely reckon upon a continued accession of power in the ratio of speeds up to at least 7,000 feet per minute.

Mr. Kenyon then went on to describe actual systems of transmission in proof of his assertion. In support of his case he mentioned the fly-rope pulleys at three cotton mills, one in Lancashire, one in Scotland, and another in Spain. They are all 28 ft. diameter, making 80 revolutions per minute, or a peripheral speed of 7,037 feet. At the first mentioned mill, two ropes, 1⅝ in. diameter, drive each of the five spinning-rooms, while the entire load of the card-room, representing 286 horse-power, is taken by three ropes averaging 95 horse-power each. The record power, however, appears to have been reached at another mill in the same neighborhood, where two 1¾ in. ropes are credited with transmitting no less than 450 horse-power at 7,200 ft., from a driving pulley 15 ft. on to a driven pulley 5 ft. 6 in. diameter.

The author then proceeded to criticize the American system of continuous rope driving, which entails the use of jockey pulleys, mounted upon a weighted carriage, designed for the purpose of maintaining an equality of tension which is never realized. A serious defect of this system of driving is that of having to depend upon one rope, the splicing of which has a habit of giving way, involving long stoppages during the process of replacement; whereas in the English system a damaged rope may be laid aside awaiting a favorable time for repairs, while the rest do the work. When it is added that Manila ropes running in shallow, open grooves of 60 deg. were used in the American experiments referred to, the author states that anything more conducive to loss of efficiency due to unnecessary friction, creep, slip, and lack of impact would be difficult to conceive.

A series of different adaptations of rope transmission were then described, and the author proceeded to consider the formation of rope pulley grooves. He said that for all-round good service there was nothing to beat the flangeless groove with the driving angle carried through to the terminals. The angle recommended is 40 degs., except in the cases of thin bands, such as are used on cotton mules.

Wettlaufer Bros., makers of concrete mixers, power hoists, and steam shovels, have opened a branch at Regina, Sask., under the management of Mr. A. E. Hodgert.

BOILER QUESTION GROWING ACUTE.

THE different provinces of the Dominion, according to present expectations, will send representatives from their local government boiler inspection branches to confer at Toronto in July, in order to strike a uniform regulation for Canadian inspectors. For a year the matter has been hanging fire and the enormous traffic in boilers together with the importance of having reliable machinery has influenced Deputy Minister of Works Fairbairn to issue a convention call.

The stand of Ontario will be for boilers built subject to its provincial regulations, accepted at face value in the western provinces. At the present time, regardless of the fact that Ontario has very stringent rules in existence, Alberta and Saskatchewan sometimes feel it incumbent to cut down the pressure. In consequence manufacturers here are handicapped in their trade.

Arrangements are also under way to have inspectors in connection with the large American insurance companies particularly interested in boilers conform to the regulations obtaining here. This would relieve the necessity of much "border" examination which now goes on.

Since the new rules came into force last July, 791 mechanisms have been examined and approved.

WORM GEARING.

A PAPER on "Worm Gearing: Its Manufacture," was recently read before the Keighley Engineering Society by Francis J. Bostock, A.M.I. Mech. E. The author first enumerated the conditions essential to insure successful gears, the relation between the speed, pressure, etc. He then described the earlier methods of making worm gearing, and concluded with a description of modern methods and machines as used in the works of David Brown & Son (Huddersfield), Limited. He said the advent of the motor car had given a great impetus to the worm gear, and in the next few years he anticipated that this form of gearing would be universally used for the final transmission on motor cars.

Features of a Successful Gear.

The author then went on to describe the terms used and the theoretical conditions which have to be fulfilled in order to obtain a successful gear. He said there were many factors entering into the design of worm gearing. The worm angle, for instance, bore an important relation to the efficiency and durability. For many years designers did not realize the importance of having a high lead angle. He said that the maximum efficiency was obtained when the lead angle approximated 43 degs., 40 mins., and that 50 per cent. efficiency obtains when the worm angle is equal to the angle of friction, at which point the worm is non-reversible. The importance of a high worm angle could not be too strongly emphasized. In order to obtain this angle it was necessary to reduce the diameter as much as possible to get a better angle and the minimum of rubbing velocity.

With regard to rubbing velocity and its relation to the pressure area of contact the author contradicted the statement frequently made that the pressure multiplied by the velocity was constant. This, he said, was not so, as it would mean that an increase of velocity would be accompanied by a corresponding decrease of pressure. The lower the velocity, the higher the permissible pressure, and vice versa.

Contact Area.

The next factor referred to was the area in contact. The author said it was often supposed that the whole of the surface was useful. This was not quite so. On the leaving side of the wheel face, the useful part falls off very rapidly from the centre; in some cases only 60 per cent. of this side was useful. Again, it was possible to get contact over several teeth, which in poorly designed gears was only interference and useless for load-carrying purposes, merely giving rise to frictional losses. There was not always the equivalent of two teeth in contact. There might be contact on portions of three or more teeth, but when projected on to the side view of the wheel this gave only the equivalent of two or less. On an average he might say that 1.4 times the projected area was useful. A finer pitch would give more teeth in contact, but a less projected area, whilst a coarse pitch gave a greater area and a lesser number of teeth in contact, the advantage appearing to be in favor of the latter. The centre distance required for the transmission of a certain horse-power at 1,000 revolutions per minute varied approximately as the $\sqrt[4]{\text{ratio}}$ and the $\sqrt[3]{\text{h.p.}}$

The amount of heat generated was another factor to be considered. The author said that when the temperature of the gears reached about 250 degs. Fah., the oil film broke down and the lubricating value ceased. This temperature rise was the limiting factor in the capacity of gears. Usually they were run at a temperature of 175 degs. Fah.

C.M.A. CONVENTION.

PRELIMINARY arrangements for the Convention of Canadian Manufacturers' Association of the Dominion, to be held in Montreal in June, were talked over at the annual meeting of the Montreal branch of the association held in the Canada Club rooms on May 5, when the election of officers for the ensuing year took place.

Improving or satisfactory conditions of trade were reported, and, in referring to the matter of Canadian industries, Howard Murray, the retiring chairman, stated that the output of Canadian factories had now reached a level equal to the demand for the products in Canada, and that new foreign markets must, therefore, be looked for in the near future. In the election of officers, T. P. Howard, of the Phoenix Bridge & Iron Works, was chosen chairman and T. R. Wardleworth, of the National Drug & Chemical Co., vice-chairman by acclamation.

WESTERN CROP FIGURES.

WHEAT seeding is drawing to a close in the West and a few days more will probably see the drill hauled off nearly all farms in Saskatchewan and Alberta and on a great many farms in Manitoba. Generally speaking, there will be but a slight increase in the wheat acreage, a substantial increase of ten to fifteen ped cent. in oats and barley and a marked decrease, probably fifty per cent., in the flax acreage. It is estimated the acreage will be substantially as follows:—

Manitoba—wheat, 2,650,000 acres; oats, 1,395,000 acres; barley, 500,000; flax, 70,000.

Saskatchewan — Wheat, 5,400,000; oats, 2,664,000; barley, 292,000; flax, 60,000.

Alberta—Wheat, 1,556,000; oats, 1,750,000; barley, 185,000; winter wheat, 175,000; flax, negligible.

Total—wheat, 9,871,000 acres; oats, 5,810,000; barley, 978,000; flax, 130,000.

Manitoba reports about 55 per cent. of wheat seeded with 90 per cent. completed in some districts. The acreage is practically unchanged. Saskatchewan reports 85 per cent. of wheat in the ground and Alberta 90 per cent.

Alberta is the only province to report a substantial increase in wheat acreage, exceeding last year's total by 300,000 acres. There is little old grain to market in any province and general conditions are excellent.

The Laurentide Company, of Grandmere, Que., recently closed two large contracts. One of these was for export of newsprint to Australia and the other was for a Texas concern. The output of the Laurentide Co. was sold practically for the entire twelve months in advance of the opening of 1914, and the new contracts, it is understood, are largely for delivery late in the year.

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Subscribers who are not receiving their paper regularly will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. XI. MAY 14, 1914 No. 20

PRINCIPAL CONTENTS.

CUTTING OFF SMALL STOCK.

IN making a tour of a number of shops one cannot help but be impressed with the many and various means adopted for cutting off tool steel and other small stock in the tool room. Many still use the rough and ready way of grinding tools off the bar at the cost of considerable time and material.

One man effected a great economy in high speed steel by having the annealed bar cut up into useful lengths by a boy with a hack saw; the process naturally being pretty hard on saw blades. Another went a step further by cutting the pieces off at the angle to give proper clearance to the tools and thus saved considerable grinding. A well known method which seems to be little used except by the makers and dealers in tool steel is that by means of the steel disk. The apparatus is so simple that it can be easily made in any shop and, probably for this reason, is not much advertised by specialty manufacturers. We have seen several abortive attempts to operate these disks on the emery wheel arbor. The nessary requirement of this machine is proper speed of the rotating disk which should be from 4,000 to 5,000 revolutions per minute according to its size. The disks can be made of any thickness from 1-32 in. up and will cut hard or soft steel as well as other metals quickly, with little waste and at any angle required.

ADVERTISING MISUNDERSTOOD.

AS fire is to the manufacturing processes so is advertising to the commercial side of industry useful, essential and dangerous. It is strange but certainly true that the impression created by an ever present and attractive advertisement will strongly influence the average buyer of machinery in favor of the article thus advocated. He will place the convictions received from the publisher side by side with the results of actual investigation.

Like all other useful means attached to our social economy, this power is sometimes abused or debased to a wrong purpose. About eight years ago there was placed on the market a certain, at the time well-known machine which was introduced, particularly throughout the West, by a most vigorous and well managed advertising campaign. The result is that fully half the middle-sized shops one visits, have at least one of these machines in the attic or the cellar along with the other "has-beens" and their advent and brief existence are now but incidents of memory. This machine could not fulfill the claims set forth for it in the advertisements of its sales agents, and furnishes one of a number of examples that have borne out the statement of one of our greatest teachers of salesmanship, "A judicious and aggressive system of advertising will sell anything."

It must be remembered that an advertisement is a statement made by the man who wishes to sell the machine and that the advertiser is strongly tempted to tell but one side of its story. While statements that are obviously untrue would not be printed by a reputable publisher, still the man who pays for the privilege is entitled to set forth all the peculiar advantages of his product and in such reasonable language as he sees fit.

The purchaser, on the other hand, need not place himself in a position to be defrauded by an advertisement. Reliable manufacturers are satisfied to use the press as a method of introducing their commodities and are willing to demonstrate the value of their products. All others have no place in connection with a business that is run upon careful conservative lines.

Precocious advertising in itself is seldom the real reason for the non-realization of the qualities expected of a new machine. Cheapness of the appliance, and lack of mechanical judgment on the part of the buyer are often the culprits whose sins are charged to misrepresentation.

When machines are bought which do not fulfill the buyers' idea of their necessary qualifications, it should sound a warning note for the manager. The buying department is in the hands of incompetent persons.

INDUSTRIAL NOTABILITIES--No. 34

MAJOR REUBEN WELLS LEONARD, Corps of Guides, Canada, and Chairman of National Transcontinental Railway Commission of Canada, headquarters, Ottawa, was born at Brantford, Ont., February 21, 1860, the son of the late Francis Henry Leonard, Merchant, (and one time Reeve of County of Brant,) and Elizabeth, daughter of the late Captain Richard Catton.

He was educated at Brantford Collegiate Institute, and Royal Military College of Canada, Kingston, whence he graduated in 1883, winning the silver medal.

He served in North-west Rebellion in 1885, as Staff Officer of Transport, and in other capacities, after two years experience on the engineering staff of the C. P. R. on surveys and construction, Lake Superior District. After the rebellion he again took service with the C. P. R. as Engineer on surveys and construction, in Manitoba, Quebec, Ontario and British Columbia, sometimes as Chief Engineer and Manager of construction of important branches.

From 1887-90 he was Chief Engineer of the Cumberland Railway & Coal Co., N.S., and from 1898-1901 he was Chief Engineer and Manager of construction of St. Lawrence and Adirondack Railway, and Consulting Engineer of Rutland Canadian Railway, and Chief Engineer of Cape Breton Railway.

MAJOR REUBEN WELLS LEONARD

In 1892 and 1893, 1904-5 and 1905-6 he was in charge of construction of Hydro-Electric Power Plants at Niagara Falls, Ont., for the Park and River Ry. Co.; at St. Catharines, for the Hamilton Cataract Power Co., and near Fort William, for the Kaministiquia Power Co., respectively. In 1906 he promoted the Coniagas Mines Ltd., of which Company he has been President since its inception. This office he has also continuously held in the Coniagas Reduction Co., which he organized in 1908.

Aside from his railway duties and private interests, Major Leonard finds time to interest himself in other matters, and is a member of the Board of Governors of Toronto University and Kingston School of Mining; Wycliffe College of Toronto, and Bishop Ridley College, of St. Catharines; and Chairman, St. Catharines Consumptive Hospital.

He is past Vice-President of the Canadian Mining Institute; a past Vice-President of the Canadian Society of Civil Engineers; a member of Council of the Institute of Mining and Metallurgy, London, Eng.; a member of the American Institute of Mining Engineers, and a past President of the Royal Military College. His clubs are Rideau and Country, of Ottawa; National, of Toronto, and Mount Royal, Montreal, and his tastes are in the direction of outdoor sports.

He married Miss Kate Rowlands, daughter of the late John Rowlands, of Kingston, Ont., and his residence is at St. Catharines, Ont.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 65
Lake Superior, charcoal, Chicago		16 00
Ferro Nickel pig iron (Soo)		25 00
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	19 00	18 35
Victoria, No. 2X.......	18 75	18 10
Victoria No. 2 Plain...	18 50	17 85

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh............	1.15
Tank plates, Pittsburgh..........	1.15
Beams and angles, Pittsburgh....	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAILS AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOILER PLATES.

		Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...		$2 20	$2 20
Heads, per 100 lbs.		2 55	2 55
Tank plates, 3-16 in.		2 50	2 50
Tubes, per 100 ft.,	1 inch	9 50	9 00
" "	1¼ in.	9 50	9 00
" "	1½ "	9 50	9 00
" "	1¾ "	9 50	9 00
" "	2 "	8 75	8 75
" "	2½ "	11 15	11 50
" "	3 "	12 10	12 50
" "	3½ "	14 15	14 50
" "	4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb. off
Nuts, Hexagon, all sizes..	4½ per lb. off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright ......85, 10, 7½, 10, 10 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off	
Wood screws, flathead, Bronze ....70, 10, 7½, 10 p.c. off	

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong, Size Ins.	Price per ft.
⅛ in	$ .05½	⅛ in	$ .12	½	$ .32
¼ in	.06	¼ in	.07½	¾	.35
⅜ in	.06	⅜ in	.07½	1	.37
½ in	.08½	½ in	.11	1¼	.52½
¾ in	.11½	¾ in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼ in	.23½	1½ in	.30	2½	1.37
1½ in	.27½	1½ in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½ in	.58½	2½ in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½ in	.92	3½ in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½ in	1.27	4½ in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 75	$15 75
Electrolytic copper	15 50	15 25
Casting copper	15 00	15 00
Spelter	5 25	5 25
Tin	36 00	35 50
Lead	4 85	5 30
Antimony	8 50	8 50
Aluminum	20 00	19 00

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, 10¾ oz. (American)	4.50	4.40
Queen's Head, 28 B.W.G.	4.40	4.65
Fleur-de-Lis, 28 B.W.G.	4.20	4.45
Gorbal's Best, No. 28	4.40	4.65
Viking metal, No. 28	4.00	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal	0.22
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., May 11, 1914.—Though the more seasonable weather of the past week has had some effect in stimulating certain trades, the improvement has not been as great as might have been expected. However, business men display an optimistic spirit regarding the near future. In fact, some firms state that trade in most lines is quite good, all things considered. Drummond, McCall & Co. report a good, steady volume of business in Montreal and the East in plates, tubes, sheets and other classes of steel. There is, however, little demand for pig iron.

Considerable interest is being evinced locally in the outcome of the debate on the Canadian Northern loan guarantee of $45,000,000, which will commence at Ottawa to-morrow. The estimates are understood to provide for an expenditure of $27,000,000 for new rolling stock, and this would mean considerable business for the various car and locomotive builders of the Dominion. It is hoped that the matter will be satisfactorily settled by the end of this week.

The Montreal Box Board Co. have purchased a factory on Seigneurs Street, on the banks of the Lachine Canal. They are remodeling it for the manufacture of box board from waste paper, and will shortly be in the market for machinery. This factory will go into operation early next fall.

The metal market continues very quiet, consumers pursuing a "hand-to-mouth" policy in their buying. As predicted last week, tin has dropped 1 cent per pound. There is a probability that a slight reduction in sheets may be made shortly, and other lines of steel, such as boiler and tank plates, tubes, etc., may fall 5 cents per 100 lbs.

Toronto, Ont., May 12, 1914.—While trade conditions show no material change over what we have been experiencing during the past few weeks, it is probable that a slight improvement may be seen in the near future. Favorable reports from the West will do much to restore confidence in business circles, although we do not anticipate an early return of anything like the same conditions as were prevalent during the same period last year.

There appears to be plenty of money in the country but the rates charged on loans are still too high. This is having an unfavorable effect on the building trade which shows a marked falling off from last year. The permits issued locally for April are considerably less than for the same month last year, and the same remark applies to the majority of cities throughout the country. There appears, however, to be an improvement this month in building operations.

Interest in the new Union Station will be revived now that the plans have been adopted by the Dominion Railway Commissioners, and orders issued for a start to be made on the work. The slight modifications suggested by the City may be made as the work of construction proceeds.

The Provincial Hydro-Electric Commission has ordered a reduction in rates for electric light and power, to be made by the Toronto Hydro-Electric Commission, to go into effect on June 1. The matter is under consideration and a decision will be announced in a week or two. If the new rates go into effect, they will be of considerable benefit to power users, the discount having been increased 10 per cent., in addition to a reduction of 2 cents per kilowatt hour, in certain cases.

The steel market is weaker than at any time during the year, a new low level having been reached. Lake Superior Producers have reduced iron ore to $2.80 per ton, f.o.b. Duluth, bringing the price back to the 1912 basis, which leaves a margin of 30 cents a ton profit. Steel bars have weakened and are now being quoted at $1.15, Pittsburgh. The National Tube Co. has announced a reduction of $2 a ton on boiler tubes and $1 a ton on 2-in. line pipes. Steel plants in the United States are operating at about 60 per cent. capacity, with little hope of improvement for some time.

Prices of American pig iron remain at the same level, the reduction in ore having apparently been anticipated by the furnaces. The production of pig iron in the United States for April shows a decrease over March. The market may show a little more activity in the near future in anticipation of second half requirements.

No change is to be noted in the machine tool market, business being distinctly quiet. The local Board of Education are receiving tenders for three 15-in. motor driven lathes, a drill press and a number of small tools and supplies.

The general condition of the metal market shows practically no change and the amount of business being done is hardly up to expectations. The market is inclined to be weak.

Ottawa, Ont., May 11, 1914.—Morning sessions of the House of Commons started this week, which means the beginning of the end of what has been an exceedingly important session from the standpoint of the business and commercial world. This session has seen the putting in force of a new tariff, which through its effect on the steel and iron industry vitally interests the whole realm of Canadian manufacturing, and particularly the machinery business.

Again, this session will see the sanction of the C. N. R. agreement by which the Government lends its credit to the road to the extent of $45,000,000, and becomes a minority stockholder in the system, owning $40,000,000 out of the $100,000,000 capital stock of the re-organized company.

The announcement that the Government had come to the rescue of the road has had a good effect on the general business situation. There may be differences of opinion as to whether the Government should have agreed to become a junior partner in the C. N. R. system. Yet they had to do something or else see the line go into bankruptcy, with

all the dangers of such a proceeding to the business fabric of the country.

In view of the fact that Canada will soon be a two-fifths stockholder in the road, the following statement of net earnings of the present lines included in the C. N. R. is of more than ordinary interest:

Canadian Northern Railway, $7,023,-868.

Canadian Northern Ontario Railway, $50,311.

Canadian Northern Quebec Railway, $285,961.

Quebec & Lake St. John Railway, $135,533.

Central Ontario Railway, $132,024.

Bay of Quinte Railway, $36,220.

Irondale, Bancroft & Ottawa Railway, $6,417.

Niagara, St. Catharines & Toronto Railway, $148,455.

Halifax & South Western Railway, $3,121.

Brockville, Westport & N. W. Railway, $25,298.

Duluth, Winnipeg & Pacific Railway (es.), $613,890.

Total, $8,461,098.

On capitalization, the two money-makers of the system are the Niagara, St. Catharines & Toronto Railway, and Duluth, Winnipeg and Pacific Railway.

Two exceedingly important measures to the business world which have already received third readings are the bills in regard to the incorporation of Trust and Loan Companies. Both bills greatly safeguard the public. The Railway Act and Amendments to the Insurance Act, two other measures of more than ordinary interest to business men, will, however, go over until next session.

Hon. C. J. Doherty introduced a bill this past week, which, while it does not directly affect machinery interests, is of interest to all business men and will be generally welcomed by them. It is a bill to make it a criminal offence to knowingly publish misrepresentations in regard to the sale of property, particularly real estate. This should tend to put an end to some of the glowing, misleading Western advertising.

Yesterday notice was given of the bill of Hon. Arthur Meighen to establish agricultural credit banks. This bill will greatly facilitate the establishment of the rural credit bank, an institution imported from Europe, but already extending in Quebec and Ontario.

MONTREAL LIGHT, HEAT AND POWER.

SURPLUS earnings of the Montreal Light, Heat and Power Co., that is, earnings available for dividends, for the year which ended April 30, will cross the $3,000,000-mark by a fair margin. A surplus of $3,000,000 would mean earnings at the rate of about 17.7 per cent. against 15.9 per cent. the previous year, but the expectation is that the actual figures will show closer to 18 per cent.

A good many guesses have been made in the last week as to what the company's statement will show. Thus, it is stated that net earnings to the end of February, or for ten months of the company's year, showed an increase of $230,-636. Allowing the same rate of increase for the last two months, that would give a gain of approximately $291,000 for the year.

The steady reduction of fixed charges through the operation of the sinking funds, a reduction which it is believed will bring fixed charges to the lowest level since the Lachine Company was absorbed in 1904, naturally reacts favorably on the surplus available for dividends, and the increase here will be considerably larger than in net earnings.

DOMINION TRADE DECREASE.

REVISED trade figures for the past fiscal year and for the month of March last tell a story of steadily decreasing trade in the Dominion. While the figures for the fiscal year show an increase of $26,697,554 in the total trade of Canada, this growth falls short of being commensurate with that of previous years, the increase for the fiscal year ending March, 1913, being in the neighborhood of $218,000,000. It is evident also that but for the opening months of the past fiscal year there would have been a decrease in total trade instead of an increase. The total trade for March last, for instance, shows a falling off of twenty-three millions as compared with March of 1913.

The total trade of the Dominion for the past fiscal year is given at $1,073,-766,098, as compared with $1,047,068,544 for the preceding fiscal year. The total trade for March was $80,873,598, as compared with $103,555,778 for March, 1913. This is exclusive of coin and bullion.

An analysis of the figures for the fiscal year shows an increase in exports over the preceding year of $78,368,869, and a decrease in imports of $51,671,315, the total exports being $455,437,224, and the total imports being $618,328,874. For March alone there is a decrease of fifteen millions in imports and of eight millions in exports. It was stated by the Minister of Finance in the Budget that trade commenced to fall off during the month of October last, but that there was every prospect that the end of the downward movement had been reached. Mr. White's prediction is apparently not borne out by the March figures, which show a heavy decrease in both exports and imports.

An interesting commentary upon Hon. George E. Foster's search for wider markets for the Dominion in lieu of those offered to the South is found in the figures for the twelve months ending February last, during which the West Indies treaty recently consummated by the Minister was in force. Much was said of the possibilities of this market under the new agreement, and of the stimulation which Canadian trade was to receive from it; but the figures show that during the time the new treaty has been in force there has been a falling off in the total trade of Canada with the West Indies of $1,878,603. The total trade with the West Indies for the twelve months ending February was $9,094,625, as compared with $10,973,228 for the twelve months preceding.

Many Imports Declined.

The dropping off of Canadian imports during the twelve months occurs in a great many important commodities. Of breadstuffs Canada imported during that period nine million dollars' worth as against eleven million for the preceding period, or a decrease of two millions; of metals, minerals, etc., $155,000,000, as against $167,000,000, or a decrease of twelve millions; of iron and steel $124,-000,000, as against $135,000,000, or a decrease of eleven millions; of provisions ten millions as against twelve millions, or a decrease of two millions; of settlers' effects fourteen millions as against sixteen millions, or a decrease of two millions; of sugar and molasses seventeen millions as against twenty-one millions, or a decrease of four millions; of furs, skins, etc., four millions as against eight millions, or a decrease of four millions.

Stimulus of Underwood Tariff.

The effect of the Underwood tariff is strongly reflected in the export figures for the twelve months ending February last. The tremendous stimulus given to the animal export is shown by an increase of nearly seven millions over the preceding year, the total value of the animal exports for the twelve months being nine millions as against two and a half millions for the preceding period.

Of the total export of nine millions, over eight millions are accounted for by export to the United States. Cattle account for over seven millions of the total export of animals for the twelve months. The total export of breadstuffs for the twelve months was $172,000,000, as against $115,000,000 for the preceding twelve months, or an increase of fifty-seven millions. Of this increase, the export of barley accounts for four millions, the export of oats for nearly nine millions, the export of wheat for thirty-nine millions, and the export of flour for one million.

An increase is shown of nearly seven millions in the export of paper, of nearly half a million in the export of potatoes, of eleven millions in the export of seeds, and of one million in the export of wood pulp.

PUBLIC SERVICE CORPORATIONS.

REPORTS as to decline in business of industries and of contracting earnings are somewhat common. In regard, however, to Public Service Corporations there have been no similar complaints. In Canada practically every public service corporation has shown an increase in earnings and if not an increase there has been no appreciable diminution. The only exceptions are one or two small lines principally operated by municipalities. During the extreme depression of 1913 these corporations generally, have done well by their shareholders.

The Financial World has reviewed the reports of 286 of the leading companies of the United States for the fiscal year 1913, and the showing made by them will prove very gratifying to those who hold shares as well as to those interested in this particular field of enterprise.

The tabulated aggregated earnings reflect a healthful and normal increase in gross and net earnings, despite the fact that in other avenues of enterprise it has proven difficult to maintain earnings and profits up to a point where they would indicate no shrinkages as compared with the former year's business.

Gross earnings of these 286 companies for the year were $866,416,400, or $54,-857,676 greater than a year ago. The percentage of increase was 6.76 per cent.; net earnings were $370,801,186, a gain of $19,492,267, or 5.55 per cent., and surplus after all allowances for fixed charges and dividends, was $81,113,567, a gain of $2,655,893, or 3.54 per cent.

During the year these 286 companies disbursed to investors in interest on bonds, including all other charges, $150,-223,407, which was $10,787,446, or 7.73 per cent., more than a year ago, and in dividends there was paid $130,777,354, which amount was $5,881,041 greater than in 1912, or a gain of 4.72 per cent.

Progress Made.

From the above tabulation it is apparent that the public service corporations in every respect have forged ahead both in gross and net revenues and in the profits and interest they have been able to divide with those whose capital has made their financing possible and successful. While the surplus over all charges and dividends shows a smaller ratio of increase, this is due to the fact that during the year the 286 companies increased their bonded debt by $87,820,793, the charges on which absorbed profits and cut into the surplus account.

This increased indebtedness was incurred principally for improvements and extensions which have not yet had much of an opportunity to develop additional traffic and revenues, but when they get fairly into play they are expected to add proportionately to the revenues of the companies.

What should attract the most marked attention is the vast amount of capital which has been invested in this class of enterprises and which can be taken as a reliable index of the prominent position these companies occupy in the development of our country.

No stronger proof could be asked for or furnished to support the argument that, next to the steam railroads, the greatest volume of capital has flowed into public service enterprises. The fact that the business has steadily developed into larger proportions with each year has shown the wisdom of this form of investment.

Of all industries none has evidenced a better ability to withstand adversity than public service enterprises.

New Incorporations

The Canada Chain Co., Ltd., has been incorporated at Toronto, with a capital of $40,000, to manufacture chains, bolts, nuts, etc., at Sarnia, Ont. Incorporators—R. V. LeSueur, A. J. McKinley, N. LeSueur, of Sarnia.

The Capital Contractors, Ltd., has been incorporated at Toronto with a capital of $40,000 to carry on business as contractors at Ottawa. Incorporators—W. H. Craig, W. Y. Denison, E. F. Holcomb, of Ottawa.

The Davies & Newton Co., Ltd., has been incorporated at Toronto, with a capital of $40,000, to carry on the business of general contractors. Incorporators—A. H. Cox, W. E. Harries, A. V. Hall, of Toronto.

The Canada Lock Co., Ltd., has been incorporated at Toronto with a capital of $60,000 to manufacture all kinds of locks and hardware at Hamilton, Ont. Incorporators—W. Ballard, H. Carpenter, O. Hodson, of Hamilton.

The Brockville Paper Box Co., Ltd., has been incorporated at Toronto, with a capital of $10,000, to manufacture cardboard boxes at Brockville, Ont. Incorporators—A. T. Wilgress, E. J. Payson, H. A. Stewart, of Brockville.

The Standard Welding Co., Ltd., has been incorporated at Toronto with a capital of $3,000 to carry on an iron and steel welding business at Hamilton, Ont. Incorporators—W. Morrison, G. W. Ballard, H. Carpenter, of Hamilton.

The Ford-Smith Machine Co., Ltd., has been incorporated at Toronto with a capital of $100,000 to carry on business as engineers and machinists at Hamilton, Ont. Incorporators—P. Ford-Smith, O. L. Ford-Smith, A. Roberts, of Hamilton.

The St. Thomas Electrical Co., Ltd., has been incorporated at Toronto, with a capital of $40,000, to manufacture electrical appliances, etc., at Toronto. Incorporators—F. A. Youmans, B. W. Whitworth, J. T. Webster, of St. Thomas, Ont.

Atlantic Constructions, Ltd., has been incorporated at Fredericton, N.B., with a capital of $50,000 to carry on business as contractors at St. John, N. B. Incorporators, T. H. Gorman, E. M. Gorman and R. C. Gilmour, all of St. John.

Trade Gossip

The Canadian Bartlett Auto Co., Toronto, Ont., capitalized at $1,000,000, have just purchased from the H. L. Wood Co. the latter's new three-storey solid brick factory on Noble Street, which adjoints the railroad yards in Parkdale. The property has a frontage of 100 feet and a depth of 107 feet, and the price was about $35,000. The H. L. Wood Co. will erect a large five-storey factory on Queen Street. The Bartlett Co. will take over their new premises soon and commence the manufacture of their cars, which are of special construction in so far that there is a second framework besides the chassis. This framework rests on two smaller tires attached to the axle and partakes of the nature of a shock absorber.

Pulp Wood Purchase.—Mr. Duncan Chisholm, representing the Chisholm Corporations, Ltd., has entered into an agreement with the Provincial Government for the purchase of the pulp wood on the Metagami River pulp limit. Tenders for this limit were received until the 31st December last, but none of the offers were acted upon at the time because certain conditions were not considered satisfactory to the Government. One of the conditions of the tender is that the company shall install a pulp mill costing not less than $250,000 to handle seventy-five tons of pulp per day and employ not less than 200 hands on an average of ten months in the year. Crown timber dues of 40 cents per cord for spruce and 20 cents per cord for other woods are to be imposed; the Crown reserving a railway right-of-way, water powers and granted lands.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Brockville, Ont. — The municipal board of works has recommended the purchase of electric drills for getting out stone.

William Kennedy & Sons, Ltd., of Owen Sound Ont., are building an addition to their steel casting plant to cost about $6,000.

Toronto, Ont.—The Board of Education is buying for the Technical School three 15-in. motor-driven lathes, one 16-in drill press, some small tools, twist drills and tool steel.

Estevan, Sask.—A. S. Porter has submitted a proposition to supply the town with light and power. The franchise required covers a period of 25 years, the town to take $50,000 worth of stock and build a transformer station. Mr. Porter would furnish a bond of $100,000. A briquetting plant may also be installed.

Regina, Sask.—Enlargements to the plant of Whitworth Bros., at Pilot Butte have been decided upon. The extensions will involve an expenditure of from $50,000 to $100,000, and include a locomotive crane, and a complete new crushing and screening plant, the order for both of which has been recently placed with MacKenzie-Hazell Supply Co., of this city.

Fort William, Ont.—The Northern Engineering Co. of Fort William was the successful tenderer for the supply of two hundred tons of bolt and iron work to be delivered to the Port Arthur Construction Co. for work on the breakwater. The contract price for this supply represents an approximate figure of $10,000. The same company is also supplying one hundred and thirty-five tons of material for the Thunder Bay Construction Co. for breakwater purposes.

Nelson, B.C.—Efforts on the part of the Nelson Board of Trade and mining men of the district to induce the Wolsey McAlpine Johnson Zinc Corporation of New York to locate its proposed new electric zinc smelting plant at Nelson have resulted in the decision of Mr. Johnson, Dr. Struthers, his associate, and Dr. E. A. Barlow, of McGill University, Montreal, who has been working ion the problem for the Canadian Government, to visit Nelson and discuss the matter with the local people.

Vancouver, B.C.—The contract entered into between the Western Canada Trust Co., and Fleishacker Bros & Johnston of San Francisco, whereby the plant of the Ocean Falls Co., situated 200 miles north of Vancouver, is to pass under the control of a merger of the Pacific Coast Pulp and Paper interests, has been confirmed. The plant at Ocean Falls is one of the largest pulp plants on the coast, and is equipped with modern machinery for turning out 140 tons of dry pulp per day. The lumber mill has been in active operation for some time in connection with the company, but the largest feature of the company's enterprise was conceded to be in the pulp industry.

Electrical

Guelph, Ont.—The Provincial Hydro-Electric Commission have ordered a reduction of rates to be made. Work in connection with new transformer stations and transmission lines will be proceeded with.

Ayr, Ont.—A special meeting of the council took place on May 5, when the Hydro Commission representative, Mr. Wilson met the council and made preparations for the coming of hydro power. Mr. Wilson said that in all probability the line would reach Ayr about the first of August. A motion was made authorizing the purchase of a building for use as a transforming station.

Municipal

Kaslo, B.C. — The town have taken over the Kootenay Electric Co.'s power plant.

Fredericton, N.B.— The city council may buy a tarvia plant for paving several streets.

Medicine Hat, Alta.—A by-law for $70,000 to construct a subway at River street has been given its first and second reading.

Oshawa, Ont. — A fire alarm system may be installed. The tender of the Northern Electric Co. for $4,875, is being considered by the council.

Simcoe, Ont.—The town council has awarded the contract for the construction of a sewer system, to S. S. Harper & Sons, of St. Thomas, Ont. The price was $25,685.

Hamilton, Ont.—It is probable that a by-law will be voted on early in June to authorize the raising of $500,000 for the construction of the proposed east end sewage disposal system.

Edmonton, Alta.—It is probable that steps will be taken to establish a municipal paving plant in the city before very long. Already $35,000 has been appropriated for this purpose.

Vancouver, B.C.—Waterworks Engineer Breckon and Fire Chief Carlisle have recommended that new water mains be laid in the warehouse district and that a gasoline engine driven pump and a water tower be purchased.

Newmarket, Ont.— Notice was given at the meeting of the town council on May 4, of their intention to raise $25,000 by debentures for the extensions of the watermains and artesian wells in the municipality.

New Liskeard, Ont.—The Town Engineer has been instructed to make the necessary measurements for the ordering of a long steel pipe to replace the present iron pipes which carry the water supply across the river.

Stamford, Ont.—A waterworks system will be installed. Tenders are being called on standpipes of various capacities, up to 120,000 gallons. A contract for steel pipe has been placed with the Canadian Allis-Chalmers Co., Toronto.

Weyburn, Sask. — Money by-laws, amounting to $155,500, were unanimously indorsed by the ratepayers on May 5, and work will begin at once on the improvements concerned, which consist of sewers, water works, and electric plant.

Newmarket, Ont.—A by-law authorizing an issue of debentures amounting to $25,000 for the extension of the water service has been passed. The report of the Water and Light Committee regarding the artesian wells has been received and adopted.

Toronto, Ont.—The Board of Control in a private conference with the Harbor Commissioners on May 7, agreed to appropriate $1,500,000 towards the harbor development work. The funds will be supplied in instalments, as the work

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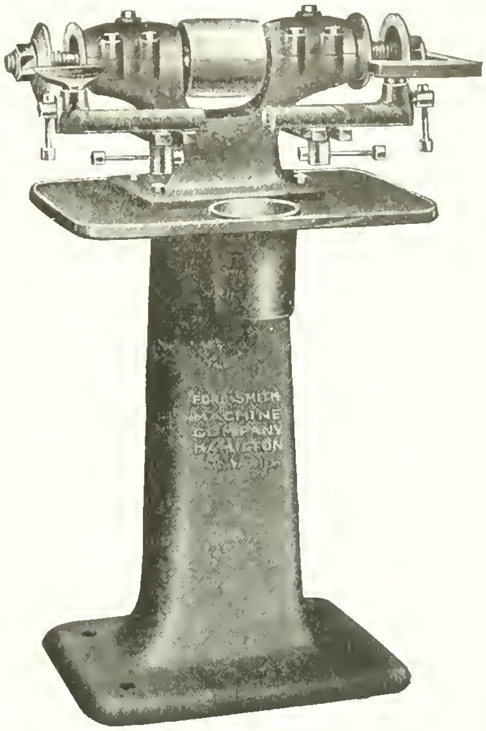

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is done, and itemized accounts received by the Board of Control.

Tottenham, Ont.—The town council has decided to spend $16,000 on a new waterworks system. The water is to be supplied from an artesian well, which has a 60,000-gallon capacity per day. The system itself is designed so as to provide a fire pressure of 100 pounds per square inch and a domestic pressure of 60 pounds. Tenders for pumping equipment and pipe have been received. E. A. James, of Toronto, is consulting engineer.

Guelph, Ont.—The annual report of the Light and Heat Commission of Guelph shows very satisfactory returns; and though the rates were reduced 5 per cent. at the begining of the year for power, residential and commercial lighting, with the increase of business that this reduction has effected, it is expected to make a further decrease in rates at the end of the year or earlier. The report shows that over twice as many electric services were installed in 1913 as in the previous year.

Wood Working

Toronto, Ont. — R. W. Burnaby has leased a site in Davisville and will erect a planing mill.

Limoilou, B.C.—A fire recently destroyed the box factory of the Turner Lumber & Pulp Co., entailing a loss estimated at about twenty thousand dollars. Arrangements have been made by Mr. A. J. Turner and Mr. Leander Conway, manager of the factory, with Mr. J. H. Gignac to carry on their box manufacturing business until the factory is rebuilt.

Englehart, Ont.—A company is being formed to purchase several thousand acres of timbered land near here with the intention of building and operating a large woodworking factory. Chairs, broom handles, door knobs, etc., are to be the products. American capital is thought to be back of this industry which expects to be well under way within the next year.

General Industrial

Galt, Ont.—M. C. Boulette, of Brockton, Mass., is opening a shoe factory here. The machinery is being installed.

Owen Sound, Ont. — The Canada Yeast Co. has asked exemption from taxation for ten years. They are to employ 25 hands.

Owen Sound, Ont. — The Union Cement Co. has asked the town council to submit a by-law guaranteeing their bonds for $60,000.

Owen Sound, Ont. — Thirty-five new mail and letter boxes are to be added to those already in use here, making a total of 57 in all for the town.

Winnipeg, Man.—It is reported that a beet sugar factory may be built here. Mr. Roland, Industrial Commissioner, is negotiating with a group of capitalists.

Port Arthur, Ont.—It is reported that a United States concern has set aside a sum of money for building a plant in Canada, and is considering locating here.

Brantford, Ont.—The Canada Glue Co. plant, situated about two miles from here, was totally destroyed by fire on May 9. The loss is estimated at $125,000, and is fully covered by insurance.

Winnipeg, Man. — The Lake of the Woods Milling Co. is negotiating for the purchase of the largest flour mill in Medicine Hat. The deal is expected to be closed this week.

Wiarton, Ont. — The Canada Casket Co. by-law was given the third reading by the Town Council on May 11, and next week the company will begin work on their plant here.

Florence, Ont. — An early morning blaze on May 4, destroyed the handle factory of Ira Webster of Rutherford. The building and stock were a complete loss.

St. John, N.B.—It is reported that W. Macdonald Mackintosh, formerly of Liverpool, England, will build a factory here to make waterproof cloth goods. The process is Mr. Mackintosh's own invention.

St. John, N.B.—W. U. Homfray, an English capitalist, states that representatives of three large British manufacturing concerns are in search of a site for the location of branch factories to handle their Canadian business.

Kingston, Ont.—F. R. Phillips, manager of the Reliance Moulding Co., Ltd., states that the work on the foundations of the new factory will begin soon. The building will be 80 x 130 feet, two-storeys high. The machinery will be removed from the Toronto plant.

Brantford, Ont.—A company is being formed to establish a pressed brick plant here. The company has a capital of $200,000, and is composed of Toronto capitalists. John T. Jackson and Thomas Knight of Toronto, are interested.

Waterloo, Ont.—The ratepayers by a vote of 550 to 175 carried a by-law on May 4, to loan $50,000 to the Globe Furniture Co. The company agrees to erect two large additions to cost not less than $125,000, on which the town secures a first mortgage. Two hundred persons will be employed. The loan is for 10 years.

Woodbridge, Ont.—This town has already begun to feel the boom of Hydro power. Although the by-law has only been carried a few days, an American firm has purchased the old American Abel factory on the Humber river. The product of their factory will be films for moving picture machines.

Cobourg, Ont. — The ratepayers will vote upon a by-law to loan $10,000 to a felt factory promoted by Mr. Z. D. Charles of Montreal. The company is to employ fifty hands the first year, increasing in ten years to two hundred. The town will have as security a first mortgage on the plant.

Galt, Ont.—Preston is entertaining a proposition from the Building Product Co., makers of sand bricks and other building material. This concern offers to establish a $50,000 plant, employing 50 men. They have $20,000 of Toronto capital subscribed, and ask $15,000 stock subscribed locally and a loan of $15,000 from the town.

Montreal, Que.—A fire occurred May 5 in the factory of Sadler & Haworth, leather belting manufacturers. It was confined to the top floor and such loss as there was is fully covered by insurance. The main stock of belting was not harmed and orders are being filled as usual. The damage done to the building amounted to about $20,000.

Listowel, Ont.—The Town Council on May 4, provisionally passed a by-law authorizing a loan of $10,000 to the Dominion Milk and Flour Co. Mr. John Hodge of Brantford, is secretary, and Mr. Richard Thomson is president of the company. The by-law will be voted upon June 1. The company proposes to spend at the outset $35,000 in factory equipment for the manufacture of butter and milk powder.

Hamilton, Ont.—Regarding the erection of the plant of the Hamilton Bi-Product Coke Co., John G. Gauld, solicitor of the latter states that the present delay in connection with the negotiation was due to the indecision of the government over the harbor improvements near the site where the plant will be built. As soon as it is known what the Government will do regarding these improvements, work on the plant will go ahead.

Burroughs Adding Machine Co. and "Safety First" Work

By C.T.R.

The Safety Movement has of late become so prominent and popular that every progressive individual and business enterprise is making some effort along certain of the lines embraced in its almost unlimited scope. Again, results surprising as well as stupendous have already proved its efficacy.

AT a recent meeting of the "Safety First" committee of the Burroughs Adding Machine Co., Mr. A. Brain, a member of the factory executive committee, gave a very interesting and instructive talk to the foremen and assistants on the "safety first" movement. He said in part:—

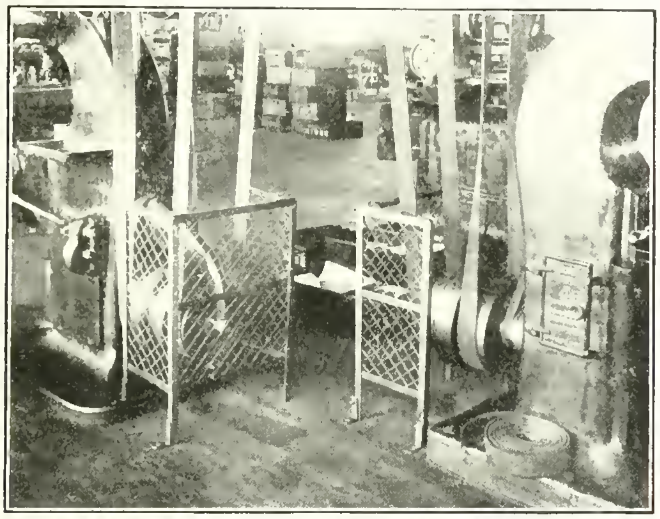
"Safety work must not be confused with the compensation law, for while the latter has no doubt to some extent introduced or advanced the safety movement, as far as we are concerned there need be no connection.

"The safety problem was no doubt given its greatest prominence by the accident prevention and relief report of Mr. Schwedtman and Mr. Emery, who in 1911 were authorized by the National Association of Manufacturers to visit Europe for the purpose of personally observing the operation of the prevailing systems of compensation for and prevention of accidents. The complete and thorough report made by these two gentlemen has, I am sure, been responsible in so many ways for the safety movement and many of the safety laws now in existence. European countries are far in advance on these subjects, but we believe that if we can let you understand what we are trying to do, we will have no trouble in securing your co-operation in seeking to remedy the unfavorable relative standing of this northern and western hemisphere.

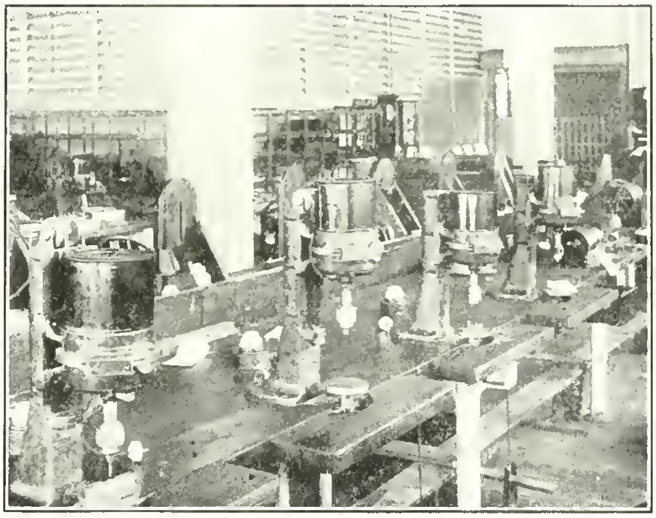
Organization Object.

"The object of our safety organization is to prevent injury and accidents both in the factory and outside through the education of employee to the necessity of doing his work in a safe manner and thereby reducing his chances of injury and making him better able to take care of his family and those dependent upon him for support.

"To promote this work effectively, we must have some definite plan of organization. In small plants this is not necessary, because of their being in closer touch with the employees and the advantages of co-operation by individual method. We realize that we have grown too large to follow this method and that some organization is necessary in order to educate our workmen and carry on the work as it should be done.



VERTICAL BELT GUARDS.
Made of wire screen of strong construction and raised from the floor so as not to interfere with cleaning operations.



GUARDS ON MOTOR-DRIVEN MACHINES.
To prevent female operators' hair becoming entangled and wound up on revolving spindle or motor armature.

PHOTOGRAPH SHOWS A BAD PRACTICE.
One workman removing a foreign particle from another man's eye. The company provides a well-equipped First Aid Department, where injuries of this kind can receive better attention; also this workman did not wear the goggles which are provided for employees when working where chips and sparks may fly.

Individual Comparisons.

"European countries, particularly Germany and England, are far in advance of us on this subject, and it would at first appear that all we have to do is to copy the policy of the older countries to effect the same result; but a closer study will show that we cannot do this for several reasons. One reason given is that Germans, owing probably to their thorough military training, have greater respect for rules and regulations. If a notice or rule is posted in Germany it is strictly followed. In America it may mean nothing. We have a large foreign population of various nationalities that make the problem more difficult. Also, American workmen are not like German workmen, and we do not wish them to be in all respects. While we can learn much from European countries, it is up to us to solve the problem in our own way.

"The workman should be led to appreciate that employers are doing their part of safety work in making and installing safety equipment, and should be shown that he alone can accomplish the greater part of this safety work by practising careful habits to protect himself and his fellow-workmen.

"Fifteen per cent. of all accidents can be prevented by safety equipment.

"Fifty per cent. can be prevented by education and co-operation of workmen.

"Get the safety habit. Talk safety as you do baseball or other popular topics, not only in the factory, but in your homes.

"Use the safety match. Any workman who carries the common match on his person or uses it in his home is not educated in the safety movement.

"Mr. Schwedtman says—Killed and wounded in ten years through two wars Spanish and Philippine—6,000 men. In the same time we have killed or wounded five million men in industrial work.

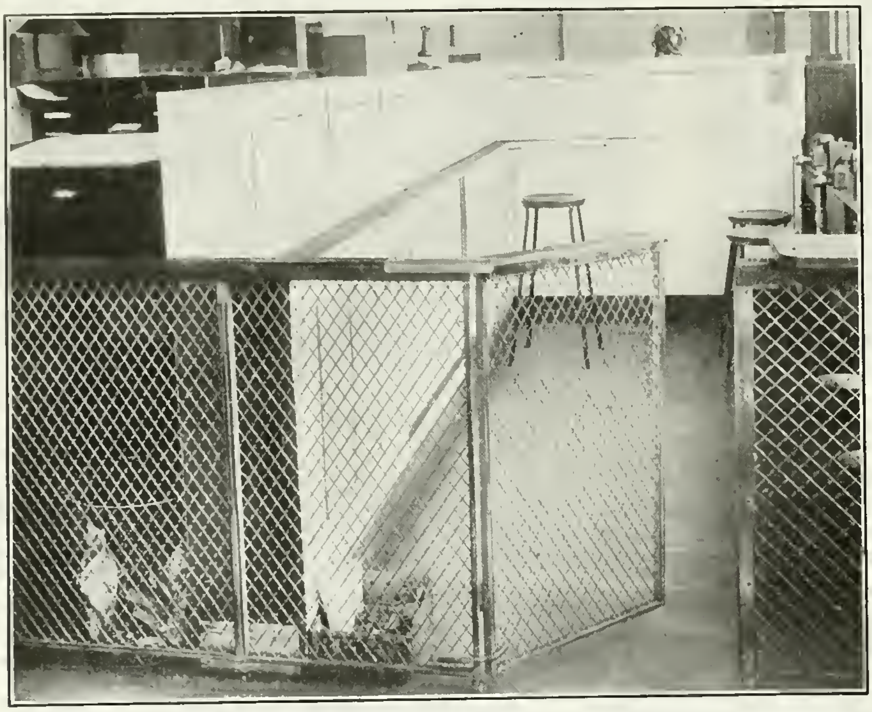
"Every workman should be carefully instructed and cautioned with regard to the dangers of his job, for all the safety devices we can install, all the rules we can formulate, all the safety designs we can post, will have but little effect unless we can prevail upon the workman to take a personal interest in his safety and that of his fellow-workman.

"We must by education overcome the workmen's objection to safety equipment, and teach him it is not cowardly to be careful, but that it is foolhardy to take chances.

"Neglect of small injuries frequently result in blood poisoning. A First Aid Department has been provided for the injured, and workmen should be taught not to neglect an injury, however slight.

"Lastly, when our people are thoroughly in earnest, when our enthusiasm has been aroused, and when our efforts become general, the safety problem will be solved, and better than it has yet been solved by European countries."

Mr. Brain illustrated his talk with lantern slides, showing how carelessness of workmen causes accidents and how careful habits will avoid accidents.



SIMPLE BUT NOVEL AND EFFECTIVE LEATHER GUARD.
Covering opening in rail of gate. This guard prevents finger or hand from entering into opening in rail when gate is opened, and which might cause painful injury.

HOLLOW METAL RODS.

THE uses to which hollow steel rods and bars can be applied in nearly every branch of mechanical engineering, says The Engineer, are so numerous and the advantages they present over solid rods are so obvious, both on the ground of saving of weight and for lubricating purposes, that if it were not for the cost of drilling there is no doubt their employment would be greatly extended. As most of our readers are, however, probably aware, the drilling of long parallel holes through steel rods is an expensive and tedious undertaking and is, moreover, frequently accompanied by disaster to the tool.

A patented process has been introduced by the firm of Dunford & Elliott (Sheffield), Ltd., whereby hollow steel bars of from about ¾ in. to 3 in. diameter and up to 20 ft. long can be produced by rolling from a drilled billet. After being drilled right through to the requisite diameter, the hole in the billet is packed tightly with a special kind of sand, which is capable of resisting the high temperatures used in the rolling process. The hole is next plugged firmly at each end by metal plugs, heated to the necessary temperature, and submitted to repeated rolling operations until a bar of the requisite dimensions and section is produced. In the rolling process, the packing material acts as a fluid or elastic mandril and maintains a hole right through the bar. The hole is approximately round and its size will, of course, bear some relationship to the length of the finished bar and the size of the original hole in the billet.

After being thus elongated, the core of packing material is removed by means of a special process, and with this object an apparatus has ben devised whereby the cost of production enables the makers to place the bars on the market at reasonable prices.

The bars produced by this process have already been extensively adopted in several branches of engineering work, and particularly for mining drills on the Rand, where the dust question is of vital importance. By the use of the hollow steel bar, a jet of water is introduced to the cutting edge, the dust is thus laid, the cutting edge is kept clear, and the efficiency of the drill greatly increased. For hollow shafting and spindles for machine tools, motor cars, textile machinery, etc., numerous applications of the hollow bars suggest themselves.

In cases where great accuracy is required, the hole formed by this process would, it is claimed, serve as a pilot hole for subsequent drilling operations, and in this respect alone would effect an economy both in labor and drills.

Standardizing Motors for Machine Tool Drives *

By Charles Fair **

The importance of motor-driven tools has now reached such proportions as to warrant serious consideration being given and definite steps taken to secure at least some measure of standardization mutually acceptable to the various interests concerned.

THIS paper is not written so much with the idea actually of settling at this time the question of standardization of motor dimensions and speeds for machine tools, as it is with the idea of pointing out a method which if followed should accomplish much toward the standardization desired. Certain of the dimensions and speeds once standardized will result beneficially not only to the machine manufacturer but to the motor manufacturer and to the machine user as well.

There will, of course, always be demands for odd combinations of speeds and requirements, and these it would be useless to attempt to standardize, but by far the majority of cases could be standardized under a heading that for convenience might be known as normal, and our efforts should be bent toward standardizing these speeds and dimensions.

For years and under generally adverse circumstances, much progress has been made in standardizing certain machine parts. For a long time it has been recognized as desirable, at least on the part of a number of machine tool builders, that something be done toward standardizing certain motor dimensions, speeds, etc., for machine tool drives. During the past five or six years attempts have been made to standardize certain dimensions and speeds for machine tool motors, but these attempts have failed for various reasons.

It would be of little use to analyze those past failures. Unquestionably there should be first of all a better understanding on the part of the machine manufacturer and the motor manufacturer of each other's difficulties, and much work is essential before material progress along the line of standardization can be accomplished.

It cannot be expected that the electrical manufacturers would change existing standards of motor dimensions or speeds, nor do I believe it would be either desirable or practicable to do so on account of the confusion that would result, but I see no reason why, if the machine manufacturer in conjunction with the motor manufacturer, will give the subject the consideration it warrants, and do their part toward bringing about a better understanding of what is really desirable in the way of speeds and dimensions, why the motor manufacturer in turn cannot incorporate, at least in part, some of the dimensions and the speeds when bringing out new lines of motors.

Obviously it would be just as impossible for the various motor manufacturers to design their motors to a single set of dimensions as it would be for the machine manufacturers to design their machines to a single set of dimensions. Notwithstanding this, however, much can be done to improve the situation. The American Society of Mechanical Engineers through its secretary, Mr. Rice, has offered to co-operate.

For the sake of convenience I have outlined five parts—namely, speeds, shafts, frame, method of drive and general.

Speeds of Motors.

There is an almost endless number of constant, adjustable and variable speed combinations available, but from this great variety certain speeds should become the logical ones for the majority of drives. The direct-current, constant-speed shunt motor speed, for instance, should logically be that of the alternating current, 60-cycle motor. Alternating-current and direct-current motor speed should be given in terms of full load or else in terms of both no load and full load. It is, of course, understood that the cycles fix the alternating current speeds, except as modified by slip, etc. Adjustable speed motors would naturally be higher in speed on the highest speed than a constant speed motor, because the adjustable speed motors were only run a certain percentage of the time at high speed. Adjustable speed motors are nearly always geared, and their speeds should be governed by a proper gear speed.

There should be little difficulty in arriving at a set of suitable speeds per horse power to be known as standards for both constant and adjustable speed motors after properly considering the items as set forth in the outline.

Shafts, Frame and Drive.

Obviously there should be little difficulty in arriving at a proper shaft diameter and key for a given horse power and speed motor. The length of shaft might offer some difficulty, but a compromise length could probably be agreed upon. Special shaft extensions and double shaft extensions, whether for hand wheel or power transmission should be considered.

A uniformity of dimension under the heading "frame" is obviously impossible, but much can be done to reduce the large variety of dimensions to perhaps two or three sets of dimensions per frame, instead of the dozen dimensions now existing. There is, of course, no reason why there should not be a uniformity in the size of the holes drilled in the motor feet per frame.

It is not only important but absolutely necessary to consider seriously the items under the head "drive" in order to arrive at some basis upon which properly to determine the best speeds, shaft dimensions, etc., to standardize; and here we should consider such subjects as diameter of motor versus length, minimum speed versus size and cost, maximum variation for adjustable speed motor and its relationship to minimum speed, cost and size and motor.

Uniformity of making motor terminals, wiring diagrams, protecting live parts, etc., are also of advantage to all concerned.

The importance of the motor-driven machine tool with relation to production has become such that the method of applying the motor to the tool in my opinion warrants far more attention than has been given to it in the past by some of the tool manufacturers, and I trust that before another year elapses that the motor manufacturer and the machine manufacturer will each have a better understanding of the difficulties of the other, and that much will have been accomplished toward the establishing of suitable standards.

*From a paper read before the National Machine Tool Builders' Association at Worcester, Mass., on April 23.

**General Electric Co., Schenectady, N.Y.

ECONOMY IN THE PRODUCTION OF GROUND SHAFTS.

By J. C. Spence.

AN investigation was recently made into the most economical method of producing ground shafts 62¼ in. long by 1.5605 in.-1.5615 in. diameter. The material was open hearth machinery steel, 0.35 per cent. carbon, 1⅝ in. in diameter. It was determined to turn one-half of the shafts to a size that would allow the grinding machine to "clean out" all of the turning tool marks without being too "fussy" about straightening the shaft, after the turning operation. The other half of the lot was ground directly from the black stock without any lathe operation.

The first half lot was turned .020 in. to .025 in. oversize at a cutting speed of 95 ft. per minute and a feed of 1-40 inch per revolution of the work. The cutting time was 11½ mins. per shaft, while the total lathe time, including handling, was 14 mins. The shafts were

then ground to the given size in $21\frac{1}{2}$ mins. This gave a total time of $35\frac{1}{2}$ mins. The other half of the lot, ground from the black, required $30\frac{3}{4}$ mins. each, to grind them to the given diameter.

The time for straightening these shafts has ben omitted because it is such a variable quantity. However, it is a much greater item after the turning operation than after the rough grinding operation (it being customary to rough-grind a lot of shafts and then to finish grind. This is due to the fact that in the turning operation, the lathe tool removes the stock in one cut thus releasing, at once, all of the strains set up in the outer shell, by the rolling operation, at the steel mill. This causes the bar to spring "out of true" to the greatest possible extent. On the other hand, the wheel cuts only a thin outer shell at each pass, and the amount of spring is correspondingly small. The next pass of the wheel cuts off the eccentricity caused by the previous pass but not necessarily adding to the eccentricity.

No Need for Springing in Grinding Machine.

Given the proper wheel and skill, there is no need of springing work in the grinding machine. Again, the fact that a turned piece "runs out," means that the grinding machine has just that much more work to do. For instance, a piece of work that has, by measurement, .020 in. of stock to be removed from the diameter, will have the equivalent of .030 in. of stock provided it runs out .010 in. (indicated). Thus we see that, even by omitting the straightening operation which would still further militate against the lathe, there is a gain of 13 per cent. in favor of the grinding machine.

The same general proposition holds true even when there is too much stock to allow the grinding machine to be economically used in the roughing operation.

Pays to Save Time on Lathe.

In this case, it can be laid down as a rule that it pays to save time on the lathe and give the grinding machine more to do. This means get rid of the great bulk of the stock as rapidly and with as little attention to refinement as possible, even to the extent of sometimes taking two or three very coarse chips in preference to one fine one.

The proposition is true because while a coarse chip leaves a very rough surface that, apparently, has much stock to be removed, this surface consists principally of the points of small triangles and the heavy modern wheel makes them disappear "like chaff before the wind."

This is better realized when it is learned that a shaft 20 in. long is turned at 15 threads to the inch by a "round nose" tool to a diameter of 2.425 in. at the tops of the tool marks was reduced to 2.400 in. (the bottom of the tool marks) in one minute of cutting time. This is an apparent stock removal of 1.9 cubic inche sper minute, and enables one to understand why the old-fashioned "finishing cut is doomed.—Grits and Grinds.

STRATFORD APPRENTICES CARRY OFF THE HONORS.

THE results of the G.T.R. apprentice competition over the system, just announced, show that Stratford apprentices again head the list, having taken the highest average marks over the system for mechanical drawing, also for practical mechanics.

The competition for the capital individual prizes over the system, which is open to apprentices at the different stations taking the highest number of marks in each subject, is to be held at Allandale on the 19th and 20th inst. There are six of the Stratford apprentices competing for this prize in practical mechanics and five in mechanical drawing. Six of these in practical mechanics received 100 per cent. in marks, as follows:—A. J. Reeves, J. K. Hamilton, R. McCardle, A. W. Barnes, A. McDowell and H. Colombo. In mechanical drawing the following boys received 98 per cent. each, and are entitled to compete for the capital prize in drawing: A. J. Reeves, A. W. Barnes, E. J. Wilhelm, H. Jones, A. Jones.

COMING CONVENTIONS.

American Iron and Steel Institute.—New York, May 22-23. Hon. James T. McCleary, secretary, 30 Church street, New York.

Master Boiler Makers' Association. — Philadelphia, May 25-28. H. D. Vought, secretary, 95 Liberty Street, New York.

Master Car Builders.—Atlantic City, June 10. Joseph W. Taylor, secretary, Karpen building, Chicago.

Railway Electrical Engineers.—Atlantic City, June 10. J. A. Audreucetti, secretary-treasurer, C. & N. W. Ry., Chicago.

Railway Supply Manufacturers' Association.—Atlantic City, June 10-17. J. D. Conway, secretary, 630 Oliver building, Pittsburgh.

American Society of Mechanical Engineers.—June 16-19, Minneapolis (headquarters at University of Minnesota). Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York.

American Institute of Chemical Engineers.—Troy, N.Y., June 17-20. J. C. Olsen, secretary, Brooklyn Polytechnic Institute, Brooklyn, N.Y.

Railway Master Mechanics.—Atlantic City, June 15-17. Joseph W. Taylor, secretary, Karpen building, Chicago.

American Society for Testing Materials.—Atlantic City, June 30-July 4 (headquarters Hotel Traymore). Prof. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Pa.

Railway Tool Foremen's Association. — Chicago July 20-22. A. R. Davis, secretary-treasurer, 730 Pine street, Macon, Ga.

Railroad Master Blacksmiths. — Milwaukee, August 18-20. A. L. Woodward, secretary, C., H. & D. Railway, Lima, O.

American Foundrymen's Associatinn. — Chicago, September 7-10 (headquarters Hotel LaSalle). A. O. Backert, secretary, Penton building, Cleveland.

Railway Bridge and Building Association. — Los Angeles, October 20-22. C. A. Lichty, secretary, C. & N. W. Railway, Chicago.

Bridge and Building Supply Men's Association. — Los Angeles, October 20-22. H. A. Nealy, secretary, Joseph Dixon Crucible Company, Boston.

Railway Electrical Manufacturers' Supply Association. — Chicago, October. J. Scribner, 1010 Monadnock building, Chicago.

GASES IN STEEL.

THE gas in blow holes is not, as many foundrymen believe, trapped air, but consists mainly of hydrogen and carbonic oxide with a small quantity of nitrogen, according to Professor Arnold in a lecture on the internal structure of steel before the Sheffield district branch of the British Foundrymen's Association. The question of gas in steel, he said, is the one branch of metallurgy that science has not yet been able to penetrate; that it is possible to get a volume of gas out of sound-looking steel several times as great as the volume of the steel itself, and that, as to the effect which this gas has on the properties of the steel, we do not know in what form it exists or what is its action.

Professor Arnold added:—" In Sheffield at the present moment experiments are being carried out on a large scale to remove this dissolved gas from steel, and I think they present a considerable prospect of success. When this is done, we are face to face with a new steel which has not been known before to steel metallurgy: a steel which has not only been deoxidized, but very largely degasified, and I will predict we shall find that steel with the same composition in many respects will have very different properties from steel containing dissolved gas. The future will prove whether the prediction I have made will come to pass."

FOUNDRY HINTS.

By R. Micks.

1—Keep all flasks in A1 condition.

2—Always order your cores as early as possible.

3—Consult previous day's core-room report when handing out jobs to secure no delays.

4—Study your molders, and give each man the class of work he can do best.

5—Have a place for everything and see that it is kept there.

6—Have daily report sheets for every department, so you can tell how you stand on any order.

7—Check up your reports every day and you will not overrun your order.

8—Watch your cupola practice and mixture, as most furnacemen do too much by guess.

9—Handle your men like men and they will use you in like manner.

10—Let no day pass that you do not try to improve on your present system.

SYSTEMATIC BUSINESS MANAGEMENT

Practical Articles for Managers, Superintendents, and Foremen, to Assist in Carrying on the Business Economically and Efficiently.

DICTATED BUT NOT READ.

SENDING a "dictated but not read" letter is about on a par with sending a salesman to a customer with a note such as this: "This is our salesman all right, but we are not responsible for his representation of our goods."

The fellow who invented the "dictated but not read" stunt must have been a cheap mail order crook, who wanted to create the impression that he was very busy indeed.

It is a very bad example to follow, for the man who hasn't time to read his letters ought to have a capable assistant to dictate and read and sign his correspondence, or else he ought not to be in business.

The "dictated but not read" letter is a reflection upon the stenographer as well as upon the office staff and the methods of the concern; moreover, it is an insult to the recipient. It is apt to convey to him the impression that this wasn't a very important letter, and that the sender didn't think enough of it to read it or see that it properly conveyed his message.

Still, some concerns do continue to send them out.—Pacific Stationer.

THE HABIT OF DOING ONE'S BEST.

THIS habit of always doing one's best enters into the very marrow of one's heart and character; it affects one's bearing, one's self-possession. The man who does everything to a finish has a feeling of serenity; he is not easily thrown off his balance; he has nothing to fear, and he can look the world in the face because he feels conscious that he has not put shoddy into anything, that he has had nothing to do with shams and that he has always done his level best. The sense of efficiency, of being master of one's craft, of being equal to any emergency, the consciousness of possessing the ability to do with superiority whatever one undertakes, will give soul satisfaction which a half-hearted, slipshod worker never knows.

When a man feels throbbing within him the power to do what he undertakes as well as it can possibly be done, and all his faculties say "Amen" to what he is doing, and give their unqualified approval to his efforts—this is happiness, this is success. This buoyant sense of power spurs the faculties to their fullest development. It unfolds the mental, the moral, and the physical forces, and this very growth, the consciousness of an expanding mentality and of a broadening horizon, gives an added satisfaction beyond the power of words to describe. It is a realization of nobility, the divinity of the mind.—Success.

THE MAN WITH THE SPARK.

HAVE you ever seen an automobile standing on the road, apparently spic-and-span and in good condition, yet absolutely powerless? It may have electric lights and self-starter and "one man top" and demountable rims, and twelve-inch upholstery, but while it is a thing of beauty it is not a "joy forever"—at least not until the garage man comes along and brings a new set of batteries, for the trouble is, the car has lost is spark. Without that spark all else is useless.

Many men there are similarly affected—men who have lost their spark—who possess outward appearance, gentility; who are willing enough to do; who may have had a good education; who show up well enough until action is required!

Every business seems to have its quota of these "sparkless" men. In surface analysis their opinions shine like the 1914 car, but when they are needed to put "punch" or "go" into a proposition, they "miss" in every cylinder.

The spark of originality—that's the most difficult of all to strike.

The spark of energy—just as necessary.

The spark of sincerity—how rare, only those experienced in the quest can verify!

Some men have energy in static form—as in the car with the batteries. They must be "charged" at regular intervals, or they will run down.

Others have a dynamo spark—self-created. Their mental magneto is always on the job. They climb hills of difficulty with ease, go through the rough places of a campaign "sweet running" and they have plenty of reserve power. Richard A. Foley in The Advertising Digest.

Lubricating Hack-Saws.—To make a hack-saw cut metal more smoothly and rapidly with less noise, and last longer, use thereon as lubricant a mixture of two parts of tallow and one of good black lead graphite—plumbago.

SCHOOLS AND SCHOOLING.

"EVERY man is as Nature made him," said Douglas Jerrold, but some are a damsight worse.

The reason is obvious; we go through life as if we had a cat's immortality, believing that there are eight others to follow; we give no thought to careful and systematic self-culture; we go to school because we must, and we leave it as early as we dare. Education is a matter of statute, and not of desire.

There is a law throughout Nature which tends to defeat what is not trained; we see evidence of it in our fields and in our business. The one thing which Nature will not stand for is the feeling that a thing is good enough. The thing that is good enough will soon be good for nothing.

Caesar Augustus said Rome was great enough, and the "Law of defeat" got right to work and tied the can on its progress. This law governs man. It allows him to quit school, but it defies him to quit schooling. If it doesn't keep him in training, he'll go backward—there is no stationary condition.

I know a man who when he left college did not leave behind him the desire to train on. He read good books, not in a systematic way, perhaps, but he read them just the same. He was partial to those little classics that he could slip into his coat pocket, and the time he spent on the street cars and on trains was put in reading them, instead of looking vacuously out of the window or staring vulgarly at the man across the aisle. The cumulative benefit of these "half hours" of study can never be computed. Stretched over a period of twenty years they gave him a fair hold on art, literature, science and history. I might even confess that they gave him what little ability is required to write this magazine every month.—Nelson Macy in Common Sense, the house organ of Corlies, Macy & Co.

SUCCESSFUL PROFIT SHARING.

ON Christmas Eve, 1912, Charles P. Foote, president of the Clipper Belt Lacer Co., Grand Rapids, Mich., announced a profit-sharing plan. A year previous the plan was first tried out in the hook carding department. The girls at that time were assured that all increased earnings would be theirs and that the piece rate would not be lowered, no matter how much they

made. The result of the experiment was that the girls from earning their former wage of $7.50 a week increased their earnings to a point where the more skilled operatives were making $12 to $15 a week and the less skilled averaged a little over $10. The output per operative was increased nearly 50 per cent., thus reducing the overhead cost to the management, in spite of the great increase in wages paid.

Encouraged by this experiment, the company announced through F. A. Stone, the secretary-treasurer of the company, in a general Christmas letter that "all who at the end of 1913 have been with the company one year or less will receive five per cent. in cash of the amount they have been paid during the year. All who have been two years in the employ, six per cent.; three years, seven per cent., and so on, one per cent. added each year, until the amount has reached 10 per cent., where it will remain indefinitely, provided the profits of each year warrant it. A nine-hour working day will be established, with Saturday half holidays without a reduction in pay."

Christmas, 1913 Distribution.

On closing the books for 1913 it was discovered that over $3,000 were available for distribution under the plan outlined, one stenographer and one drayman earning the maximum 10 per cent. dividend. The dividends were placed in the pay envelopes Christmas Eve, 1913, with a little note expressing the gratification of the company that the amount was as large as it proved to be, and expressing the hope of still better things in the year to come. The good will that this distribution engendered was an inspiration to the management and many incidents came to their notice where this Christmas present helped an employee over serious trouble.

Early in January the cottage occupied by one of the girls in the hook department was totally destroyed by fire, not even the furniture or household effects being saved. She and her mother had never felt they could afford to carry insurance while making payments on the home, but when the Christmas check came they decided that insurance on both the home and contents would be the very best use they could put it too. The fact that they were insured was, therefore, wholly due to this timely sharing of the year's profits.

Outside of the indirect benefit of a closer bond of fellowship with their employees, the direct results of the profit-sharing plan were as follows:

The yearly output was nearly doubled, with only a slight increase in force. Cost of the Clipper belt lacer was reduced nine per cent., in spite of the fact that the men making it increased their earnings 20 per cent. The output of one important piece of work for which 20 cents was being paid on piece work was so greatly increased that, figured on the former daily wage basis, it would have cost only 11 cents labor per piece.

Figuring all departments, the average gain to operatives was 19 per cent., and the average direct gain to the company nearly 9 per cent.

UTILISATION OF EXHAUST STEAM

SOME valuable data as to the advantages realizable by utilizing, in steam-turbines, the steam now wasted at many collieries and iron works were included in a paper read before the Nottingham Society of Engineers on March 11 by Mr. W. C. Mountain, M.I. Mech. E. The steam consumption in the case of a 750 k.w. plant working under different conditions was said to be as follows:—

WITH DRY SATURATED STEAM SUPPLIED AT 70 LB. GAUGE PRESSURE.				
Vacuum		26	27	28
Consumption at full load	lb. per kw. hour	30.5	26.8	25.0
Consumption at three-quarter load	lb. per kw. hour	29.5	27.8	26.0
Consumption at half load	lb. per kw. hour	32.2	30.3	28.3
WITH EXHAUST STEAM AT 16 LB. ABSOLUTE.				
Vacuum		26	27	28
Consumption at full load	lb. per kw. hour	39.3	36.5	31.7
Consumption at three-quarter load	lb. per kw. hour	41.0	37.1	33.1
Consumption at half load	lb. per kw. hour	44.2	40.0	35.7

As illustrating the amount of exhaust steam available at collieries, Mr. Mountain gave the following figures of the consumption of non-condensing winding engines in different cases:

Size of Winding Engine.	Consumption per Shaft Horse-Power.	Boiler Pressure.
in.		
32×72	129	...
45×84	83	80
18&28×84	177	140
36½×78	114	60
36×78	95	180
32×72	70	120
40×78	48	105
32×72	102	80
36×72	129	80
22×52	58	100
40×78	88	100
26×54	43	127
60×84	178	20

The cost of a mixed-pressure turbo-generator plant with condenser and all accessories was stated to be about $30,000 for a 500 kw. installation; $35,000 for a 750 kw. plant, and $42,500 for 1,000 kw. unit. Taking interest at 5 per cent., and depreciation at 10 per cent., the total annual costs would be $7,000, $8,000, and $9,500 per annum respectively.

In this estimate no allowance is made for the value of the waste steam. The cost per unit with a load factor of 100 per cent. would be .152, .116, and .104 cents for the three plants respectively, which, if a stand-by plant were also provided, would be increased by about 50 per cent.—Engineering.

WHAT IS AN OPTIMIST?

"AN OPTIMIST," said Mr. J. L. Garvin, the brilliant editor of the "Pall Mall Gazette" and "the Observer," "is a man who sees every difficulty in his path, who is not daunted by them, who hopes for the best, who leaves as little as possible to chance, and who works like a tiger."

Mr. Garvin, who was unconsciously describing himself in these words, was the guest of the Optimists' Club, London, at their monthly dinner—a gathering of many business men whose creed is that optimism is the secret of business success.

"Looking at life from my point of view," he said, "one thing which is of much effect is imagination—the play of ideas. A man should strive to his utmost not to be a victim of routine, but see the world a fresh thing every morning. He must say, 'How is this thing done; how can it be improved?'

"The difference between men who do not count and men who do count is measured by the extent to which they embody the thoughts and actions of other men, or bring a fresh store of perception to reinforce the common stock. All success worth having is no more than ideas realized in action, and the man who believes life is worth living, and puts both hands to the task he has undertaken is far more likely to have ideas if only from the necessity of having them, than the weary Willies of the moral world who think there is nothing new, and nothing true, and that it doesn't matter anyway.

"Optimism in action," he declared, "is the secret of the 'Nelson touch.'"

Finding Compressed Air Leaks. — When steam escapes you can generally see or hear it, and when there is a leak in an ammonia pipe line that also is immediately evident, but a leak in a compressor air line entailing an appreciable loss may go for a long time unnoticed; not that it is more difficult to make the air line tight, and to keep it tight, than the others. An Illinois manufacturer at regular intervals puts essence of peppermint into the air system, and then has all the pipes inspected for leaks. If the smallest amount of air escapes anywhere it is revealed by the odor.—Ex.

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

STRESS ON BOLTS OF SPLIT FLY-WHEEL.

By J. R. Brodie.

I NOTICED in a recent issue of your journal a problem propounded by Mr. Westwood regarding the stresses acting on the bolts of a split fly-wheel. As such discussions tend to add to the interest in your journal, I shall endeavor to set forth my theory and a calculation. The data given are as follows:—

Diameter 12 ft., r.p.m. 150, and weight 10 tons. The hub was held intact by four $2\frac{1}{2}$ in. bolts, with an initial stress in each of 1,000 pounds, and the rim was secured by four 2 in. bolts, each under an initial stress of 700 pounds.

The stress in the rim of the fly-wheel is found by the following formula (a):

$$S = \frac{R \times N^2 \times W \times F}{2 \times 3.1416} \text{ where}$$

S=Total rim stress in pounds.
R=Mean radius of fly-wheel in feet.
N=Number of revolutions per minute.
W=Weight of rim in pounds.
F=Constant for centrifugal force of whole rim=.000341.
3.1416=Ratio of circumference to diameter of circle.

The weight of the rim is not given and, for this reason, it is necessary to ascertain its stress per sq. inch.

The weight of a cast-iron rim may be found by formula:

$W = 2 \times 3.1416 \times R \times 3.125$, where
W=Weight of rim.
3.1416=Ratio of circumference to diameter.
3.125=A constant for cast-iron.
R=Mean radius of wheel.

Weight of rim$=2 \times 3.1416 \times 6 \times 3.125 = 117.813$ pounds.

By formula (a), the total stress in section of rim one inch square and 12 ft. diameter will equal

$$S = \frac{6 \times 22500 \times 117.8 \times .000341}{6.2832} = 863$$

pounds per sq. in.

The width of the crown and its thickness are not given. Therefore it is necessary to base the calculation for the total weight of the rim upon the assumption that the dimensions are as follows:—Width 18 in., thickness 4 in., or cross sectional area$=18 \times 4 = 72$ sq. in.

The total stress on the rim in pounds =sectional area in sq. in. $\times$ 863= $72 \times 863 = 62{,}136$ pounds.

Area of a 2 in. bolt=3.1416 sq. in., and total stress on each bolt=62.136÷4 =15.534 lbs. The initial stress on each rim bolt due to the tightening is 700 lbs.

Now, if the strains on the bolts increase in proportion to the loads they are called upon to carry, the total stress on each bolt is 15,534 + 700=16,234 pounds. The stresses on the hub bolts, in my opinion, are very moderate, and are, therefore, not considered.

It was said by "Centrifugal" that the speed of the wheel was too high. The maximum allowable strain in a cast-iron fly-wheel rim is 1,000 pounds per sq. in., which corresponds to a rim velocity of 6,085 ft. per minute, which brings the wheel in question within safe limits. Its rim velocity is 5,655 ft. per minute, while the rim stress is 863 pounds per sq. in.

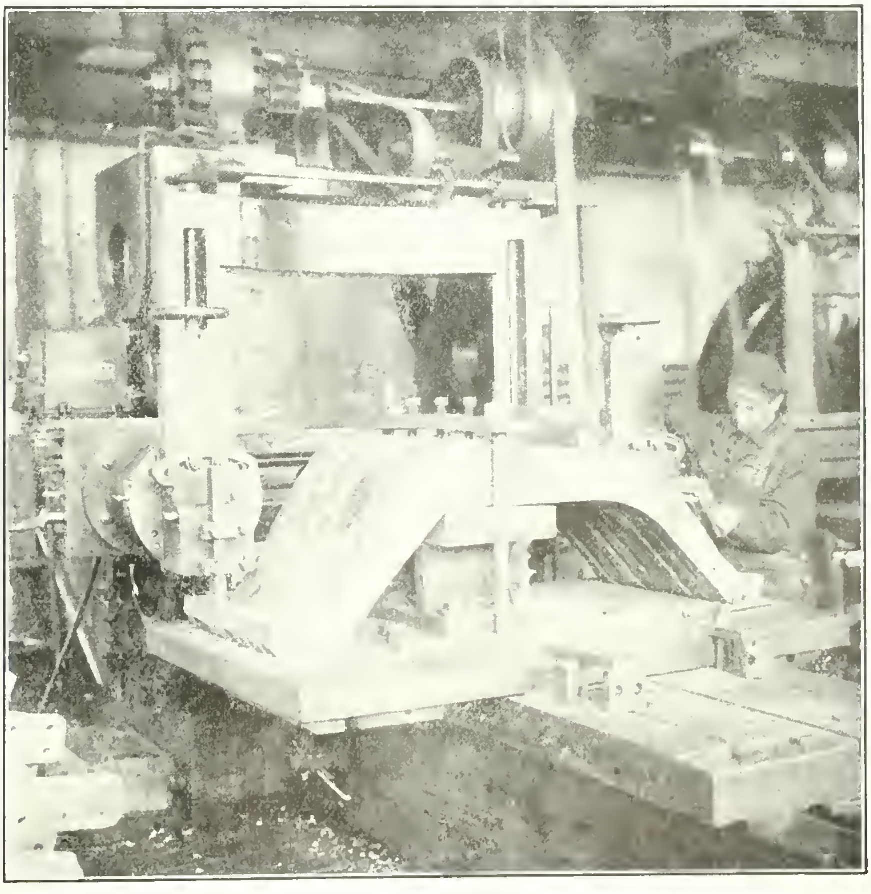
MACHINING TRUCK EQUALIZERS.

By J. H. W.

AT the Dominion Works of the Canadian Car and Foundry Co. a great economy has been effected in machining passenger car truck equalizers by the use of the device here illustrated. The equalizers are approximately 66 inches over all, yet are planed on a 30-inch planer. This is effected by mounting the tool heads on two extensions, and clamping the work on an auxiliary table mounted on the planer table.

The equalizers, which are for six-wheel trucks, are set up in batches of eight (one set) at a time, and are supported by a block machined to the correct height. This block is an old flanging die picked off the scrap heap. As may be seen, it is planed off at the top in such a way that the equalizers have only an inch or two of bearing on it in order to facilitate setting up the work. The auxiliary table consists of a disused marking-off table, tapped for the holding-down bolts; so the fixture cost practically nothing.

In some shops these equalizers are machined one at a time on a shaper, but the Canadian Car and Foundry Co. find that their own method saves a great deal of time, in spite of the fact that it takes about an hour to set the work



MACHINING TRUCK EQUALIZERS.

up. The output is 24 equalizers a day, or three sets.

No doubt the job would take considerably more than an hour to set up if the equalizers were forged to a template; but the company's practice is to rough forge them and afterwards bend them to final shape in a bulldozer. The forgings are thus practically all the same size and shape, and no trouble is found in selecting sets of eight so nearly of a size that they can be set up together on the planer comparatively quickly.

THE AIR FURNACE IN THE FOUNDRY.

By U. K. N.

FOR many years the foundry cupola was considered the principal of the the various agents conducive to premature greyness in foundry managers, but with the advent of modern chemistry and scientific mixing of iron, the cupola and its vagaries have been thoroughly mastered. We are now informed, however, that the cupola has seen its day and that the air furnace is the last word in foundry practice.

While for many years the foundries producing the finest malleable castings have realized that the air furnace was essential to the best results, it is only recently that grey iron founders have turned to these furnaces for the solution of the problem of uniformity of product. To the small jobber, the air furnace is not a necessity, and owing to the increased cost of operation as compared with the cupola, it is doubtful whether it will ever be popular; but with the large foundry making machinery castings of intricate design and requiring unusual strength, the air furnace has already proved itself of remarkable value. So thoroughly are the qualities of air furnace iron appreciated on many Government contracts, and not only is the analysis of the castings designated, but it is expressly specified that air furnace iron must be furnished.

Superiority Over Cupola.

There are many reasons why the iron melted in an air furnace is, and should be, superior to that of a cupola. The principal point in favor of the air furnace is that the metal is not at any time in actual contact with the fuel and has no opportunity of absorbing impurities principally sulphur, from the fuel. Again, the fact that the entire charge is melted down before tapping guarantees that the metal is thoroughly mixed in the bath of the furnace and assures a uniformity not possible where the iron is filtered down through successive layers of coke.

Every practical founder knows that no matter how carefully he watches the operation of his cupola there will be considerable variation in the sulphur content of his castings. As before stated, this is due to absorption from the coke, and while it may not be sufficiently excessive to cause trouble, still the fact remains that a variation of several points in sulphur occurs in successive heats. With the air furnace this is eliminated. If a mixture be charged to produce sulphur .04 per cent. in the casting, the analysis will show this amount, not only for one heat, but day after day so long as the particular analysis is desired.

Owing to the uniformity of melting in an air furnace, a considerably larger proportion of scrap or cheaper grade of iron may be used. This can be done without the sacrifice of strength, and bars breaking at from 4,000 to 4,200 are not uncommon, and this without a particle of steel in the mixture. Air furnace iron producing the much desired combination of low silicon and low sulphur assures castings of great strength, and an analysis of 1.20 silicon and .04 sulphur in the casting may be secured day after day. To obtain this in a cupola would necessitate the use of large proportions of high priced charcoal iron with best selected scrap, or probably No. 2 pig iron.

Air Furnace Disadvantages.

The most serious objection advanced to the installation of air furnaces is the cost of operation. However, this is not so formidable as might be supposed. Air furnaces are operated with soft coal with a melting ratio of one to four. This is as compared with cupola iron melted with coke at a ratio of about one to seven (including bed). When one considers that the price of 72 hour foundry coke is nearly double that of run-of-mine coal, the saving in favor of the cupola is not so pronounced.

There are advantages in favor of the cupola, however, that should not be overlooked. One of these is the facility with which small work may be poured. The usual method in handling an air furnace heat is to melt it down and take the iron out in either one or two ladles, depending upon the capacity of the furnace. It will be readily seen how impracticable it is to pour many castings weighing from two hundred to three hundred pounds with a ladle of low silicon iron holding possibly ten tons. To get around this, it is necessary to draw the metal in smaller ladles, plugging the furnace after each successive tap. When this is done it is doubtful whether the metal reaches all castings with the same degree of uniformity.

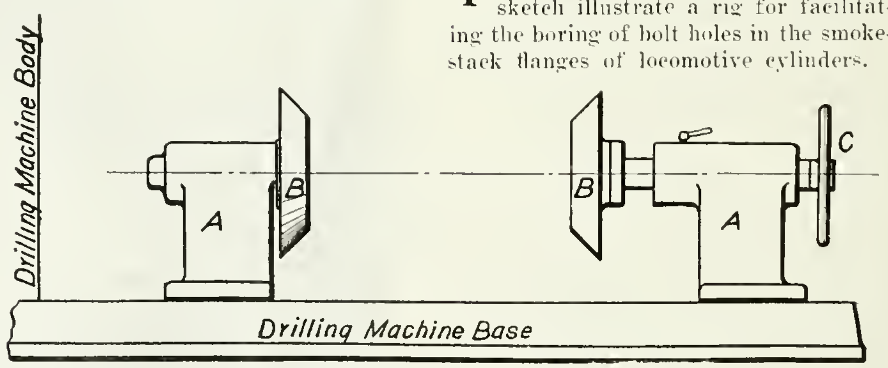
Another disadvantage of handling air furnace iron comes up in a shop where the character of the work requires iron of several different analyses during one heat. Take for example a shop pouring rolls where various depths of chill is required. It is physically impossible to accomplish this from one air furnace mixture, and it is manifestly not economical to operate an air furnace for each particular size of roll. Of course, the practice of taking several mixtures from a cupola during one heat is not conducive to accuracy, but where there is but one stack operating in the shop it is often necessary.

In the earlier furnace installations the iron was melted down by natural draught, but the present day desire for "speed" has developed stoker-fed furnaces operated by forced draught. There has been considerable objection to this upon the ground that there is excessive oxidation and danger of burning the iron. This criticism is probably not altogether borne out by experience, and forced draught furnaces produce equally as good iron in considerably shorter time. Taken all in all, the air furnace in the foundry has come to stay, and with the progressive foundryman its installation is always welcomed.

FIXTURE FOR DRILLING SMOKE-STACK FLANGES.

By E. W. Slingsby.

THE accompanying photos and sketch illustrate a rig for facilitating the boring of bolt holes in the smokestack flanges of locomotive cylinders.

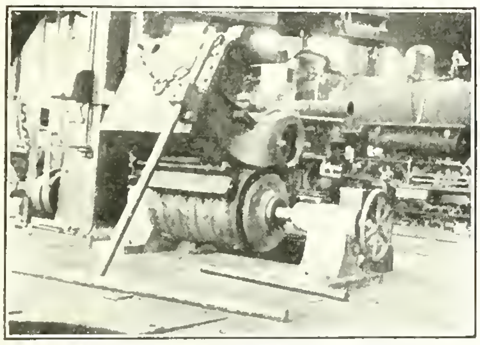


FIXTURE FOR DRILLING SMOKESTACK FLANGES.

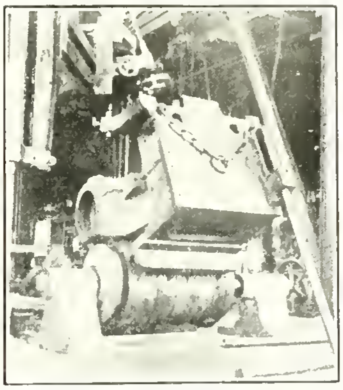
Two heavy cast iron brackets AA are rigidly bolted to the base of a radial drill with raising and lowering arm. Each bracket is fitted with a large cast

iron cone BB, which is free to revolve. The rear one has lead screw and hand wheel C for the purpose of feeding the cone up to the job like the tail stock of a lathe.

In operation, the cylinder casting is placed between the cones and clamped up with the hand wheel. It is located



DRILLING LOCOMOTIVE CYLINDER SMOKESTACK FLANGES.



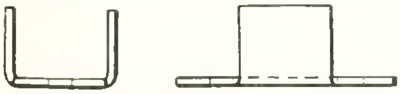
DRILLING LOCOMOTIVE CYLINDER SMOKESTACK FLANGES.

and held at the correct angle by the leg bolted to the centre facing as shown in photographs, and is fastened by a locking handle provided. Previous to the adoption of this outfit the work was done with a pneumatic drill and much time was lost in adjusting clamps, old man, etc.

A SIMPLE HAND-PRESS JOB.

By W. G.

THE tools herein illustrated are primarily intended for use in a case where the total number of pieces to be



FIGS. 1 AND 2. FRONT AND END VIEW OF FINISHED COMPONENT.

produced is not sufficiently large as to warrant the outlay of a more expensive set of tools, yet at the same time to turn out work accurately and expeditiously. Figs. 1 and 2 are front and end views respectively of the finished component. Fig. 3 is a side elevation of punch and blanking die and Fig. 4 is a plan of die with punch removed.

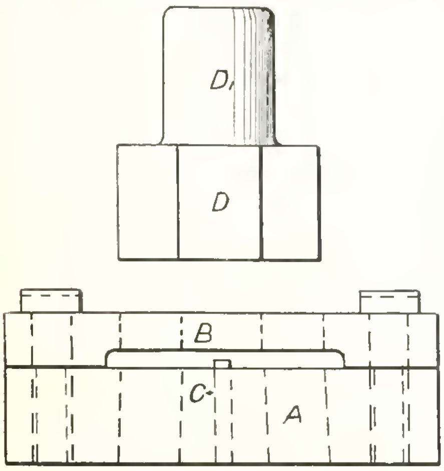
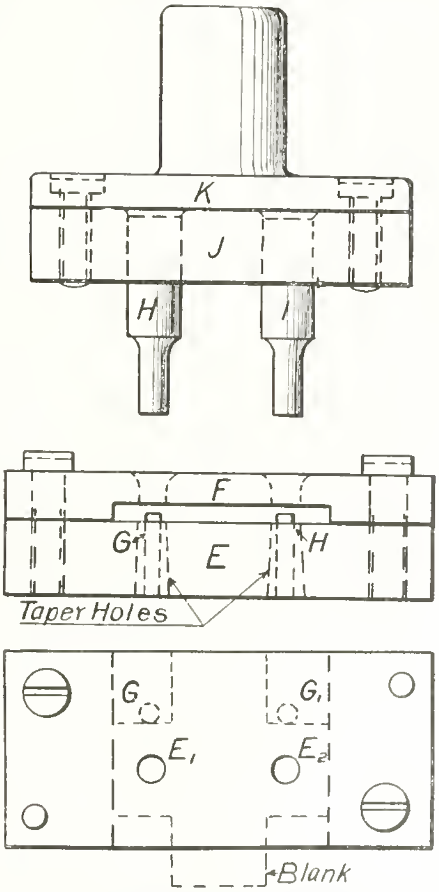
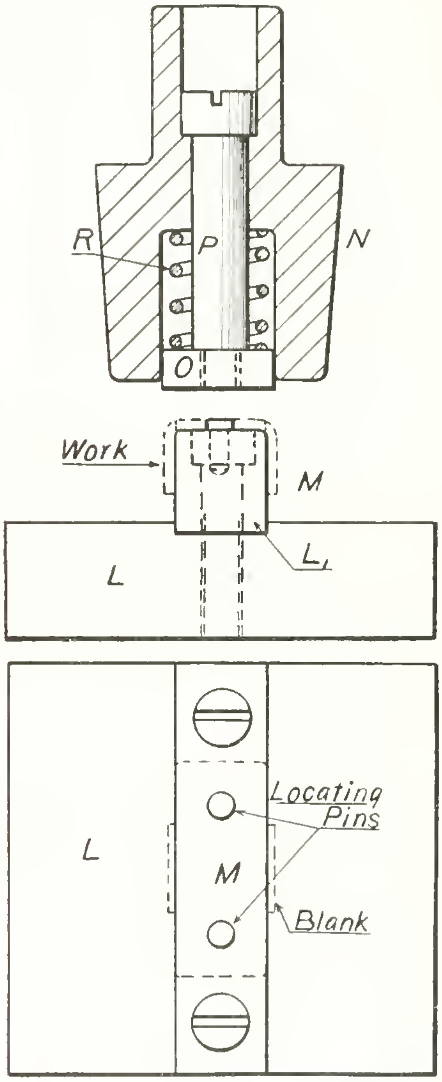


FIG. 3. SIDE ELEVATION OF PUNCH AND BLANKING DIE.

The cutting bed or die A is made from a rectangular block of tool steel, and should, if possible be forged, as this adds considerably to its strength. It is very essential, however, that care should be exercised during hardening, as the success of the tool very largely depends upon this operation. Part B is the combined stripping and guide plate. This is made from mild steel, and is secured to the cutting bed A, by means of the cheese head pins and dowels as shown. The stop peg C is made from cast steel, its object being to provide longitudinal location of the "strip" when blanking.



FIGS. 5 AND 6. FRONT ELEVATION AND PLAN OF PIERCING TOOLS.



FIGS. 7 AND 8. TOOLS FOR BENDING.

Part D is the punch; this being made from a rectangular block of tool steel. The shank D1 is turned to a diameter to suit the hole in the press ram. Figs. 5 and 6 are front elevation and plan of piercing tools for the second operation. The cutting bed E consists of a rectan-

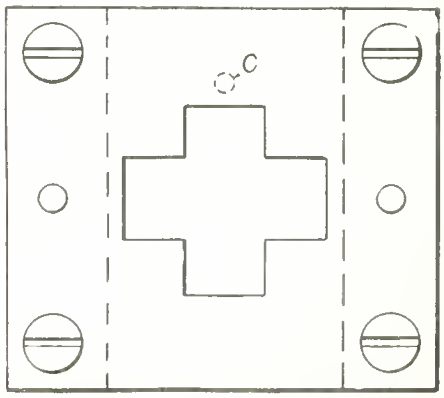


FIG. 4. PLAN OF DIE WITH PUNCH REMOVED.

gular block of tool steel provided with two holes E_1 and E_2. It is essential that the said holes should be slightly tapered towards the base in order to provide the necessary clearance for the piercings; the taper, however, should not be less than 1° each side, otherwise the slugs will have a tendency to choke the die, thus causing considerable stripvenience. Part F is the combined stripping and locating plate, being made from mild steel, and secured to the die as shown. Parts G and G^1 are the stop pins for longitudinal location.

The piercing punches H and I are made from best cast steel carefully hardened and tempered, and should be a driving fit in the mild steel punch plate J; it is preferable, however, that the ends of the said punches should be slightly riveted over as shown, thus providing additional security. Part K is the punch plate holder. This is made from mild steel and is casehardened on its bearing face for the purpose of taking the thrust of the punches when in operation.

Tools for Bending Are Showing in Figs. 7 and 8.

The base L consists of a cast iron block, in the centre of which is provided a tongue groove L_1, the object of this being to provide location for the bending block M, which is made of mild steel and need only be surface hardened. The bending punch N is also made from mild steel, and should be casehardened. Part O is the pressure plate; this can be made from any suitable material, its purpose being to hold the component quite flat during the process of bending. The pin P is for securing the aforesaid plate to the punch body. It is very essential, however, that both plate and pin should be a free fit to the punch body, thus allowing the spring R to have full play upon the component.

SAFETY HINTS TO EMPLOYEES.

THE following safety hints appear in a recent issue of the Burrough's Adding Machine Co. Employees' Magazine, and are, we understand, the work of the company's superintendent, Mr. A. Brain.

1.—Treat your shopmates with courtesy and work in harmony with them.

2.—Acquire habits of caution for your own protection and for that of your shopmates.

3.—Use general tools with care and return them in as good condition as when taken.

4.—Avoid wearing loose fitting clothing and jewelry or gloves on or about the hands especially around machine tools.

5.—Before throwing on power always look the machine over carefully, and be certain every part is in working order.

6.—Adjustments and oiling should be avoided when a machine is running.

7.—Whenever possible, start a machine by hand, to be sure all moving parts are free.

8.—When in doubt concerning your work or the operation of any machine, ask your foreman.

9.—When operating a machine, give the work your undivided attention. It may save spoiling a job, if not more serious damage.

10.—When taking charge of any equipment, examine it carefully and report any breaks or defects, otherwise you will be held responsible.

11.—Never fool with a machine and avoid scuffling with shopmates during working hours.

12.—Do not leave material, tools, or work lying on the floor, where anyone might stumble over them, nor in overhead trestles or platforms, where they might fall or be jarred off.

13.—It is extremely dangerous to set cutting tools in a moving machine.

14.—Do not lounge on a moving machine and keep a respectable distance from all moving parts, especially gears and cutters.

15.—When through work, clean the bench, vise or machine with brush and waste, and see that all small tools are returned and checked.

16.—Before throwing in an automatic feed, be sure the stops are set so that no damage will be done either to the work or machine by its use.

17.—Form the habit of never standing in line with swiftly revolving parts, such as emery wheels, pulleys, etc.

18.—Practice economy in use of oil, waste, emery, files and other supplies, as careless waste of theee things causes enormous losses in many shopes.

19.—When working around a dangerous machine be sure good footing is provided and never remove guards or safety devices, unless absolutely necessary in order to do the work.

20.—Never leave waste or rags where they might ignite or cause fire.

21.—Grind off overlapping edges of chisels, drifts, punches, set hammers, etc.

22.—Never pound or hammer a file.

23.—Form careful habits and cultivate a thoughtful and deliberate frame of mind when about your work.

24.—An orderly exit of employees at noon is important, especially when it is necessary to descend staircases.

25.—The wearing of long coats by workmen will be discouraged. Aprons not ragged and fastened with strings that will break easily under strain are better.

26.—Never attempt to stop a machine by grabbing the belt.

27.—When replacing a belt, stop a machine dead or reduce speed less than one-half.

28.—In replacing belts, adjust them on the driven pulley first.

29.—When handling a belt between two overhead pulleys, never place the ladder between the shafts nor rest it against a revolving shaft.

30.—Do not be ashamed to shift belts with a stick instead of the hand, and for overhead work, always use a stick reaching nearly to the floor.

31.—If you will shift a belt by hand, use the palm with thumb and fingers extended and look out for metal splicings.

32.—Do not remove or tighten oiler nut by the power of the machine or without oiler being touched at outer end.

33.—Do not wipe chips from revolving cuter with the fingers or a steel scale. Use a brush on the off side and with care.

43.—Never reach across the revolving oiler to regulate the oil feed.

35.—Be sure stops are set and that everything will run clear during the entire cut before throwing in feeds.

NEXT STEP IN OUR CIVILIZATION. WHAT?

In an interesting article in the Manchester Guardian (England) the author asks what will be the next step in our civilization that will follow the iron age, or as some people prefer to call it, the steel age. Some day it is conceivable that the mineral and coal supplies of the world will give out, and then the world will have to fall back upon the vegeterian substances for all materials of construction, these being the only ones that can be reproduced with such rapidity that there would be a constant supply.

When this time arrives, the author says, the great bulk of the world's requirements will be met by the products of the field and the hill side. Fuel will either be grown directly, as timber, or more likely be distilled from suitable plants in the form of alcohol and oils. Structural materials will then, again, be mainly stone and wood, and only tools, ornaments, and products to meet special requirements would be made of metal. When such a time comes the world will literally go "back to the land" and evolve a new civilization, multiplying the productivity of the land to a degree at present beyond imagination.

In the history of the world, the present mineral age is but one brief day.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Attention is drawn to the alternating course in arithmetic, a concurrent study of which is recommended with that of the Question and Answer Series.

RELATIVE TO FALLING BODIES.

PRINCIPLES.—All bodies fall equally fast. That is, a piece of paper and a stone, if dropped into well at the same instant, would reach the bottom at the same time, but for the resistance of the air which has a greater effect upon the lighter bodies. In the following problems the effect of air resistance is not considered.

A falling body accelerates uniformly or, in other words, it gains exactly the same amount of speed for each second during its fall. This increase in speed is known as the force of gravity or (g) and varies slightly at different points on the earth between the equator and the poles. Its value for our latitude is 32.16. It is easily seen that, if a falling body gain this amount in speed each second, its speed at the end of two seconds will be 64.32; at the end of three seconds. $32.16\times3=96.48$ feet per sec. and so on. From this we get the formula

$$v=gt \quad (1)$$

where v=velocity in ft. per sec.
t=the time in seconds during which the body falls.
g=the force of gravity=32.16.

* * *

Question.—What would be the velocity ottained by a brick after falling during 7 seconds?

Answer. — $v = gt$ or $v = 32.16\times7 = 225.12$ ft. per sec.

* * *

Question.—From what height must a stone be dropped in order to strike the ground with a speed of a mile a minute?

Answer.—A mile =5280 ft., and a mile in 1 minute

$$= \frac{5280}{60} = 88 \text{ ft. per sec.}$$

For determining the distance in problems of falling bodies we use the formula,

$$h = \frac{v_2}{2g} \quad —(2).$$

The height from which a body must fall to attain a given velocity equals the square of the given velocity divided by 2×32.16.

In the above formula.
v=velocity in ft. per sec.
h=height in feet.
g=force of gravity=32.16.

Supplying values,

$$h=\frac{88\times88}{32.16\times2}=120.39 \text{ feet.}$$

Question.—Considering that Niagara Falls is 160 feet high, at what speed does the water strike the bottom?

Answer.—Changing the above formula to suit this case we have

$$h = \frac{v^2}{2g} \text{ that is } v^2=h\times2g \text{ or } v=\sqrt{2gh},$$

applying this to the problem

$$v=\sqrt{2\times32.16\times160}=104.4 \text{ ft. per sec.}$$

* * *

Question.—A man in a balloon drops a sand bag from a height of 5,200 ft. How long would it take to reach the earth?

Answer.—Where time is involved we use the formula $h=\frac{1}{2}gt^2$—(3). Changing this to find t we get

$$t = \sqrt{\frac{2h}{g}} \text{ where t is the time in seconds}$$

$$\text{or } t=\sqrt{\frac{2\times5200}{32.16}}=\sqrt{323.38}=17.98$$

seconds.

* * *

Question.—A gun in the crows nest of a battleship, 90 feet above the water, discharges a shell in a horizontal direction, with a muzzle velociety of 144,000 feet per minute. What will be its range?

Answer. — The motion given to the projectile by the powder does not affect the force of gravity and it will strike the water in the same time as if it were dropped. This time would be, according to formula.

$$t = \sqrt{\frac{2h}{g}} \text{ or } t = \sqrt{\frac{2\times90}{32.16}}=\sqrt{5.5970}$$

$=2.37$ seconds.

In 1 min. the shell goes 144,000 feet horizontally. In 1 sec., it travels $\frac{144000}{60}$ and in 2.37 secs, $\frac{144000}{60}\times2.37=$ 5688 feet or a little more than a mile.

* * *

Question.—A ten-foot fly wheel bursts at 1,000 r.p.m. (1) How high will a piece of the rim go which happened to fly straight upwards? (2) At what velocity will it go through the roof 60 ft. above?

Answer. — (1) The initial velocity would be

$$\frac{10\times3.1416\times1000}{60}=523.6 \text{ ft. per sec.}$$

The height to which a body will go is the same as that from which it would have to be dropped in order to acquire the same velocity. Therefore,

$$h=\frac{v^2}{2g} \text{ or } h=\frac{523.6\times523.6}{2\times32.16}=4262.3 \text{ ft.}$$

Answer.— (2) This velocity would be the same as if it were dropped from a height 60 ft. less than this or 4262.3—60=4202.3 ft., using formula

$v=\sqrt{2gh}$ or $v=\sqrt{2\times32.16\times4202.3}$ $=519.89$ ft. per sec.

* * *

Question.—If a 12 -inch emery wheel should burst while making 2820 r.p.m., what would be the greatest horizontal distance that one of the pieces could go?

Answer.—The greatest possible range would be attained by a piece flying off at an angle of 45 degs. with the horizontal. Its initial velocity in this direction would be

$$\frac{2820\times3.1416}{60}=147.655 \text{ ft. per sec.}$$

Its horizontal and vertical initial velocities would be represented by the sides of a right angle triangle, whose hypotenuse is at an angle of 45 degs. In which case, both sides would be the same.

The horizontal initial velocity would be the cosine of 45 degs. $\times$ 147.655 or $.70711\times147.655=104.404$ ft. per sec. The vertical initial velocity would be 147.655 multiplied by the sine of 45 deg., which is, for this angle, of course, the same thing.

The time during which a body is rising is the same as would take it to gain this same velocity in falling from rest and the total time of flight would be twice this as it also has to come down. The formula for this would be

$$v=gt \text{ arranged to find (t) or } t=\frac{v}{g}$$

$$\text{or } t=\frac{104.404}{32.16}\times2=6.49 \text{ seconds.}$$

Its horizontal speed is uniform and is 104.404 ft. per sec. Therefore, the distance it travels is 104.404.49—677.582 ft.

* * *

Question.—In the above problem, how high would the piece go?

Answer.—From the former solution we find that its initial velocity in a vertical direction is 104.404 ft. per sec. Using formula $m=\frac{v^2}{2g}$ we have height

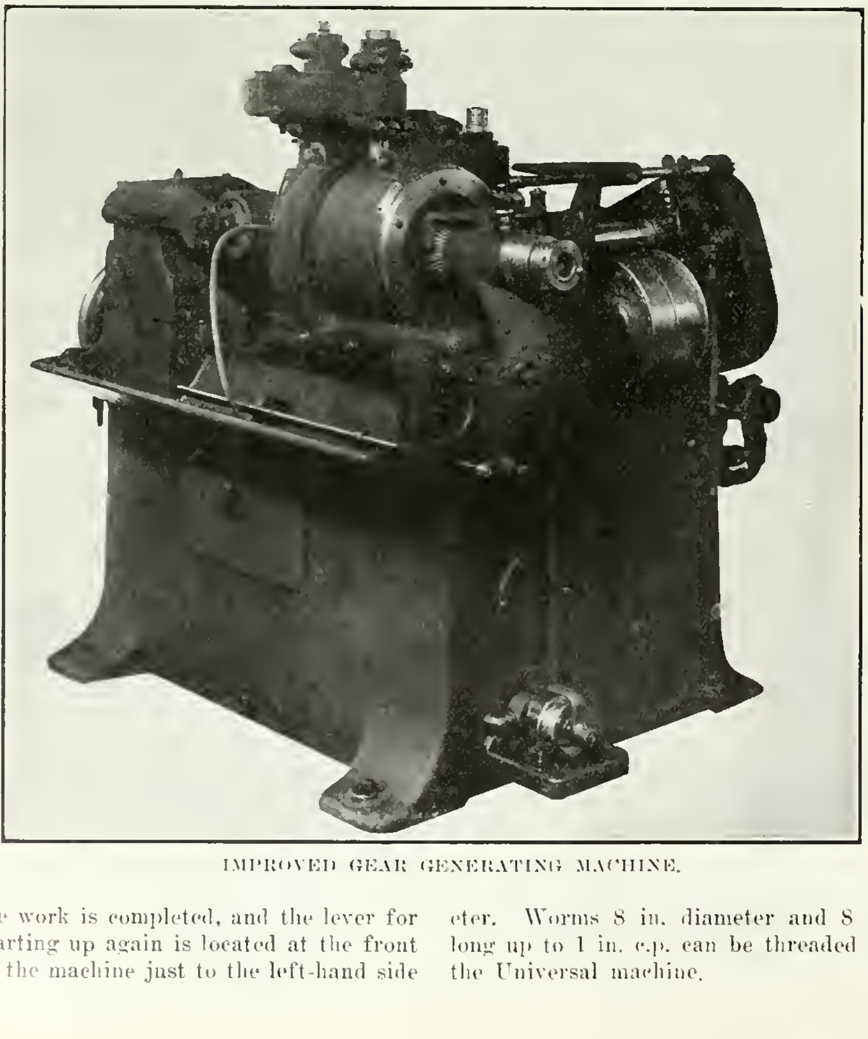
$$h=\frac{104.404\times104.404}{2\times32.16}=169.47 \text{ feet.}$$

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

IMPROVED GEAR GENERATING MACHINE.

THE Lees-Bradner Co., Cleveland, Ohio, builders of automatic gear generators and thread milling machines, have recently improved the drive of their No. 5 gear generator, as will be seen by referring to the illustration here shown. The improvements are as follows:—The cone pulley drive has been replaced by a single pulley drive situated below the shaft on which the cone was previously located, and from this lower shaft, gears transmit the power up to the original shaft, giving nine changes of speed to the cutter, with a range of cutter revolutions from 44 to 147, and a back gear range of 3 1/3 to 10.8 to 1. The extreme back gear of 10.8 to 1 makes it possible to take advantage of the rigid construction of the machine when using coarse pitches, and the low back gear of 3 1/3 to 1 makes the production very good when using small hobs of light pitches.



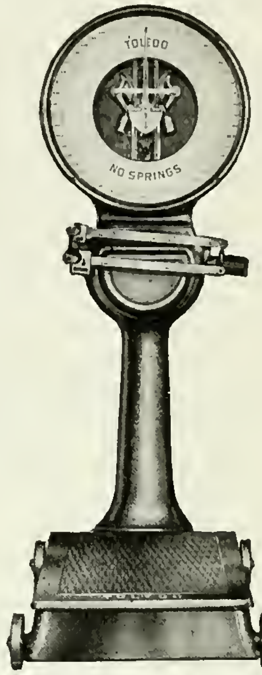
IMPROVED GEAR GENERATING MACHINE.

The machine automatically stops when the work is completed, and the lever for starting up again is located at the front of the machine just to the left-hand side of the micrometer hand wheel. The longitudinal feed of the work slide is controlled by a jaw clutch operated by a hand lever from the front of the machine replacing a friction clutch. A new shield has been supplied for the feed gearing, which is readily swung back to cover the gearing when in use from the rotation shaft to the feed screw when used on the Universal machine. This new design is readily equipped with an electric motor drive of a constant speed, as a motor can be located at the rear of the machine either above or below the main pulley. The loose pulley is mounted on roller bearings running on a hardened and ground bushing, thus eliminating the trouble so often encountered with loose pulleys wearing their bearings out and becoming noisy and inoperative.

The machine will cut spur gears, helical gears, worm wheels, and thread worms. The standard type takes work up to 14 in. diameter, while the special machine takes work up to $17\frac{1}{2}$ in. diameter. Worms 8 in. diameter and 8 in. long up to 1 in. c.p. can be threaded on the Universal machine.

THE TOLEDO HEAVY CAPACITY SCALE.

AN interesting and serviceable type of weigh scale is being put on the market by the Toledo Scale Co., Toronto, Ont., for use in factories where a rapid indicating and accurate register is required. The accompanying illustration will give the reader an idea as to the general design of the apparatus.



THE TOLEDO HEAVY CAPACITY SCALE.

The mechanism, situated behind the dial, is exposed to view, but is in a dust-proof housing. It consists essentially of floating compensating double pendulums, one counter-balancing the other, thus preventing inaccurate results when the scale is used on an uneven floor. Springs have been eliminated entirely, thus giving the scale a greater degree of accuracy and longer life. The lever shown in front is the tare-arm. This device makes it possible, when weighing goods in trucks or boxes, to deduct the tare, the scale automatically showing the net weight of the goods. This feature is claimed to effect a considerable saving in time.

The bearings are made of special tempered steel, and are self-aligning, besides conforming to the knife-edge pivots in their natural position throughout the entire bearing surface, thus eliminating wear. The weight is registered on a dial similar to that of a clock, by an indicating hand which travels round.

The scale is fitted with a brake, which holds the machine in a fixed position when in use. At the back of the scale is a handle which, when turned, releases the brake, so that the scale can be moved. The weighing mechanism is at the same time automatically locked, thus eliminating any possibility of damage when being moved over rough surfaces. In the dormant—that is to say, stationary scale—this feature protects the indicating mechanism when the scale is not being used.

The speed of the scale is controlled by a dash-pot regulator, which checks the vibration of the indicating hand. The scale is also equipped with a shock-absorber, which, in connection with the dash-pot regulator, relieves the weighing mechanism of any shock from goods being dropped on the platform.

These scales are made at the company's factory at Windsor, Ont., in sizes, with capacities from 250 to 1,500 pounds.

CROSS SLIDE FLAT TURRET LATHE.

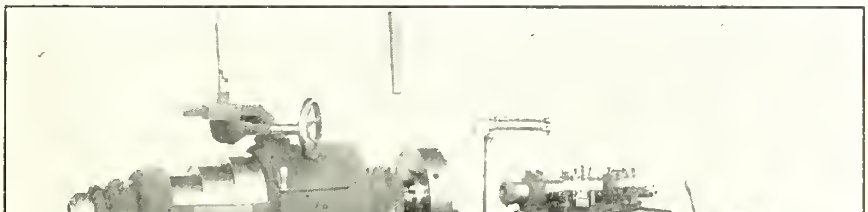
THE 2¼ by 26-inch **Modern** cross slide flat turret lathe, here described and illustrated, is a product of the Modern Machine Tool Co., Cincinnati, Ohio, and embraces all the features of the **Modern** rigid flat turret lathe, with the exception of those enumerated as follows:—

The cross-slide has 195 square inches of bearing surface on the carriage, and has a long narrow dovetail guide to prevent cramping. It has full length taper gib to take up wear and a parallel gib on the rear for holding down. The centre position is automatically and positively located by a taper locking bolt on the head end of the carriage, which may be disengaged when the cross-feed is used.

The cross-slide has ten stops, which stop the slide in either direction, and has 7 in. of travel. The ten stops may be used for one tool or in combination for any series of tools. The stops are engaged by a series of plungers located at the front of the carriage, all of which are operative from any location of the slide. The graduations for micrometer adjustment of the cross-slide are located on the periphery of the cross-feed screw hand wheel.

The cross-slide has independent feed in both directions, and may be engaged while the machine is in operation; the start, stop and reverse being controlled by a single lever entirely independent of the carriage feed. When cross-feed is operated by hand, the screw with two bevel gears are the only moving parts. A 15-in. three-jaw geared scroll chuck, with four sets of jaws, is regularly furnished.

The swing over the vees, carriage and turret is 20 in., 16 in., and 6 in. respectively; the travel of carriage 26 in., and that of the cross-slide 7 in. The range of speed is from 18 to 350, and that of the feed from .005 to .085, while the floor space and net weights are 4 ft. by 11 ft., and 6,150 pounds respectively.

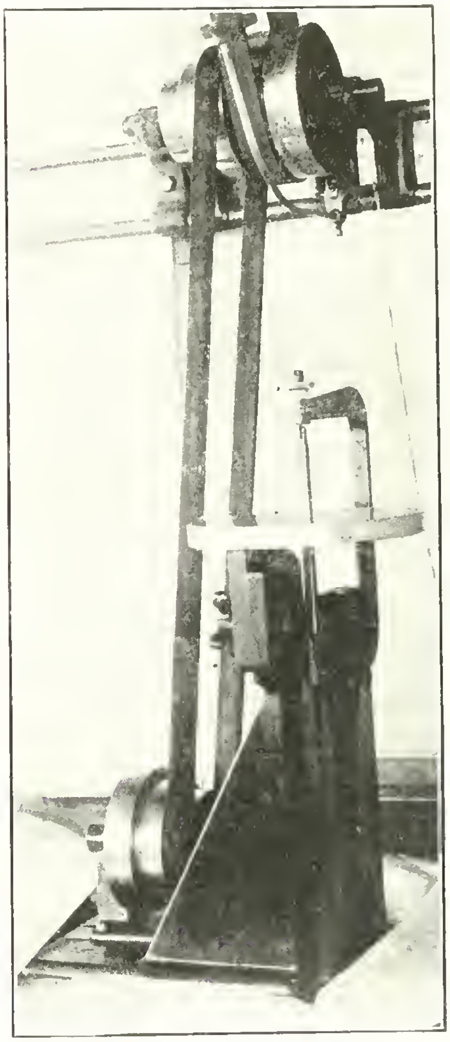


CROSS SLIDE FLAT TURRET LATHE.

BENCH FILING MACHINE.

THE bench filing machine, here described and illustrated, is designed particularly for work where it is desired to file perfectly straight and true surfaces to any required angle, such as cutting dies, jigs and template work. The height from bench to table, which is adjustable, and of 9 inches diameter and graduated, is 18 inches. The stroke has adjustment of from 2 inches to 5 inches. The machine has three-step cone pulley drive, and weighs about 145 lbs. complete, with counter ready for shipment.

This filer will not take the regular stock files, a special parallel file being used, which is supported from both ends, the same as a jig saw. The files are 8 inches in length, and are used like a back saw blade. With this machine, it is claimed, accurate work can be rapidly produced, using either files or saws. Files are carried in stock by the makers of machine, the B. C. Ames Co., Waltham, Mass., U.S.A.



BENCH FILING MACHINE.

Twelve Things to Remember.—The value of time; the success of perseverance; the pleasure of working; the dignity of simplicity; the worth of character; the power of kindness; the influence of example; the obligation of duty; the wisdom of economy; the virtue of patience; the improvement of talent; the joy of originating.—Marshall Field.

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Vol. XI. MAY 21, 1914 No. 21

PRINCIPAL CONTENTS.

THE TRANSMISSION PROBLEM.

THE rivalry between the different methods of power transmission reminds one of a very similar competition between naval gun makers and armor manufacturers. Electric transmission, even in its crude state, found many applications in which it proved superior to the line shaft drive. Makers of line shaft attachments, however, got busy, and produced roller and ball bearings, lubricating devices, etc. Belt makers and chain drive men are improving their products and simplifying the methods of application to reduce the cost and increase the safety of operation.

The motor drive has undisputed sway in many situations, particularly in connection with large machines and those whose use is intermittent. The belt drive still has many advantages in a more or less narrowing sphere and the newer chain drives are establishing themselves in fields where they cannot easily be superseded.

The more recent developments in available means of power transmission have made necessary particular study on the part of those intrusted with the devising of drives for different purposes and conditions. In fact the transmission problem is becoming more important and complex. It is one in which poor judgment may be the cause of very serious loss, and in which on the other hand, well advised installations will effect large savings.

AMERICAN COMPETITION.

A LARGE part of the labors of our legislators is periodically devoted to the revision of the tariff; this is for the purpose of fostering and protecting our infant industries—protecting them from the ravages of our competitive neighbors. If similar industries be owned in both countries by the same individual, he is doubly protected to the extent of the tariff, and can raise both selling prices just that amount.

Although it is true that our younger enterprises require fostering, American competition should not be made the goat for all conditions that cannot readily be explained in other ways. Competition is one of the greatest incentives to achieve, and the keener the rivalry the greater the perfection attained by both participants. Why is it that Australia with its climatic perfection and natural advantages is secondary in importance among the British Dominions? We have in Uncle Sam a worthy and most useful competitor. In such ways as we have so met him, our commercial conquests in other parts of the world have been made correspondingly and comparatively easy.

If we sift out from the vast work that Uncle Sam does for us, the actual cases where the possession of natural resources counts for more than unselfish personal effort on our part, there will be left a large measure the greater part of which we turn over to him as a prize for his unchallenged, aggressive competition instead of doing it at home ourselves. A more serious drawback than the efforts of our neighbor is the fact that foreign capitalists who invest in Canada, and our own financiers in particular, seem to expect higher dividends from their enterprises here than elsewhere, in spite of the fact that the capital investments are necessarily smaller.

There is no reason why many commodities cannot be as well manufactured in Canada as in the United States. This is borne out in statements by officials of some firms operating in both countries to the effect that some things can be made more cheaply in Canada. New enterprises are continually originating across the line in spite of the larger firms already and aggressively organized and with no tariff to protect them.

It is a significant fact that more patents have been issued per capita of population to Canadians than to any other people, and that the quality and extent of Canada's public works compare favorably with those of any nation. People talk about the great octopus of competition with our larger neighbor as something that will smother our efforts in the cradle and sap rather than stimulate our national vigor. It is for us to face this competition and to turn its influence to our account. To do otherwise would be to admit defeat before the battle has been fought.

INDUSTRIAL NOTABILITIES--No. 35

JAMES REID WILSON, one of Montreal's best known and highly respected business men, died in London, England on May 11, after a brief illness, of pneumonia.

Mr. Wilson was born in Glasgow, Scotland, about sixty-four years ago, arriving in Montreal at the age of twenty, and immediately entering upon that career which made him one of the most successful men of affairs of his generation. He was the son of the late John Wilson, who was M.P. for the division of Govan, now a suburb of the city of Glasgow, and one of the most prominent men of North Britain.

Entering the firm of Thomas Robertson & Co., iron and hardware merchants, Montreal, he, by sheer, hard work and business ability became its president, its largest stockholder and mainspring.

The great conflict between the Dominion Coal and Steel Companies, headed by Jas. Ross and J. H. Plummer, respectively, found Reid Wilson in the thickest of the fight, constituting with Mr. R. B. Angus and the then president of the Coal Company, the famous big three of that organization. When the Steel Company won out, Mr. Wilson

THE LATE JAMES REID WILSON.

accepted the inevitable and took office as vice-president of the Dominion Coal Co. and director of the Steel Corporation under Mr. J. H. Plummer.

Mr. Wilson, at the time of his death, was president and managing director of Thomas Robertson & Co., Ltd.; vice-president of the Dominion Coal Co.; chairman of the Canadian Board of the Phoenix Assurance Co., Ltd., of London, England; director of the Canadian Steel Foundries, the Dominion Steel Corporation, the Montreal Locomotive Works, the Montreal Trust Co., the Wayagamack Pulp and Paper Co., the E. A. Whitehead Co., etc.

He was a member of the Mount Royal, St. James, Forest and Stream, Royal Montreal Golf, and Royal St. Lawrence Yacht Clubs, and the Royal Thames Yacht Club, of London, England, and a member of the American Presbyterian Church.

In 1880 he married Miss Hallett, of Mobile, Ala., and is survived by his widow, two sons and two daughters; Mr. John Wilson, who is one of the directors of Thomas Robertson & Co., Mr. James Gemmill Wilson, Mrs. F. C. Shorey, all of Montreal, and Mrs. Robert G. Sare, of Halifax.

Mr. Wilson's remains will be brought to Montreal for interment.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	.....	$13 65
Lake Superior, charcoal, Chicago	.....	16 00
Ferro Nickel pig iron (Soo)	.....	25 00
	Montreal.	**Toronto.**
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 75	18 10
Victoria, No. 2X.......	18 50	17 85
Victoria, No. 2 Plain ..	18 25	17 60

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh............	1.15
Tank plates, Pittsburgh..........	1.15
Beams and angles, Pittsburgh....	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

NAILS AND SPIKES.

Standard steel wire nails, base..	$2 15
Cut nails $2 60	2 65
Miscellaneous wire nails...	75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.	2 85

BOILER PLATES.

			Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...			$2 20	$2 20
Heads, per 100 lbs.			2 55	2 55
Tank plates, 3-16 in.			2 50	2 50
Tubes, per 100 ft.,		1 inch	9 50	9 00
"	"	1¼ in.	9 50	9 00
"	"	1½ "	9 50	9 00
"	"	1¾ "	9 50	9 00
"	"	2 "	8 75	8 75
"	"	2½ "	11 15	11 50
"	"	3 "	12 10	12 50
"	"	3½ "	14 15	14 50
"	"	4 "	18 00	18 00

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb. off
Nuts, Hexagon, all sizes..	4½ per lb. off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Wood screws, flathead, bright ......85, 10, 7½, 10, 10 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off	
Wood screws, flathead, Bronze ....70, 10, 7½, 10 p.c. off	

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	**Black**	**Gal.**	**Black**	**Gal.**
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 75	$15 75
Electrolytic copper	15 50	15 50
Casting copper	15 00	15 45
Spelter	5 25	5 25
Tin	36 00	35 00
Lead	4 85	5 25
Antimony	8 50	8 50
Aluminum	20 00	19 00

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, $10\frac{3}{4}$ oz. (American)	4.50	4.40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4.40	4.65
Viking metal, No. 28	4.00	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal	0.22
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., May 18, 1914.—In the machinery trade things are extremely quiet this week, though in other lines trade continues to slowly improve. Business men feel that the banks might now safely abandon their cautious attitude and "open up" a little with great advantage. As a local railway man put it a day or two ago: "The banks in their original scare over the real estate business were rather disposed to shut down on every sort of business, but they have found that this will not do. If that policy be pursued, then the statement of Sir Thomas Shaughnessy that the country is sound at the core could not be substantiated, for if the banks refused to help legitimate undertakings, the business of the country would collapse, and ruin would ensue. If a man wants accommodation and the banks say they won't give it to him, he has only one resource, and that is to 'bust,' and the banks can't afford to let any good legitimate business do so."

To-day sees the opening of the Goods Roads Congress, in connection with which an exhibition is being held at the Montreal Arena. Mussens, Ltd., occupy a large space, and are exhibiting stone-crushing machinery, concrete mixers, road rollers, portable engines, etc. Among other exhibitors are to be found the Canadian Fairbanks-Morse Co., London Concrete Machinery Co., Jones & Glassco, etc., etc. A number of prominent Canadian highway engineers, as well as others from Europe and the United States, are attending the congress, and some interesting papers are expected to be read.

Metals, etc.

The general condition of the metal market continues quiet. Canadian pig iron is down 25 cents this week, while English pig shows a rather firmer tendency; in fact, there may be a slight rise to report shortly. A number of inquiries for pig iron have been received, but so far few real orders have materialized. Last January and February foundries placed their orders covering their anticipated consumption till the end of June. Owing to bad trade most of them find they have enough pig on hand to last till September or October. Hence the quietness of the market.

Toronto, May 19, 1914. Trade conditions, generally speaking, are about at the same level as have been prevailing during the past few weeks. The outlook is rather brighter, although any marked improvement can hardly be expected for some time. There has been a decided increase, locally, in the number of building permits issued, only a few, however, call for steel construction. Quite a number of municipalities are now inviting tenders for civic works and equipment, but how much of the work will be proceeded with this year is not certain. In some cases tenders are called for the purpose of making estimates for use on some future occasion. Until money is easier and loans can be floated at more reasonable rates, there will be little done in the way of municipal improvements.

Makers of railroad equipment, we are afraid, will have to continue to exercise a little patience with regard to the C. N. R. deal. It is likely that a decision will only be arrived at after a prolonged debate at Ottawa. It is reported that the Toronto Street Railway will be ordered by the Ontario Railway and Municipal Board, to build a large number of cars and in addition, lay several miles of track in new districts. The report of the Board has been completed but has not yet been submitted to the railway company. A transportation problem will probably be solved by a local real estate dealer, who, we understand, is proposing to inaugurate a motor-bus service for the purpose of carrying passengers to a suburban subdivision. The experiment will be watched with interest, as some experts claim that this type of vehicle is better suited than street cars for operating in and around cities, on account of their greater mobility.

The steel trade has not made any recovery after the recent decline, but there is a feeling in some quarters that a buying movement may take place next month, as stocks are light and consumers will be forced to come into the market. Prices on structural shapes remain at the same low level, which should be an inducement for consumers to take advantage of the market. The passing of the dividend on the common stock of the Dominion Steel Corporation was probably expected by many, but it will be a matter of general regret that the returns for the fiscal year show such a heavy decrease in net earnings, the decrease being $500,000.

No change can be reported in the pig iron market, business being still very dull. Small tonnages are the general rule and many foundries are operating at considerably below capacity. It is reported from the United States that there has been a further slight curtailment in the production of the blast furnaces.

The machinery market is still dull and little business is being done by local dealers. We understand that the C.P.R. have bought a punch and shears for the shops at North Bay, and that a firm of dealers report having sold a radial drill to the Gillson Co., Guelph.

Conditions in the metal market are looking brighter with a fair amount of business being done. Electrolytic copper has advanced ¼ cent and casting copper ½ cent a pound. Tin is weaker and has been marked down ½ cent, while lead is also slightly weaker.

Ottawa, Ont., May 18, 1914. The session of Parliament which is drawing to a close has been marked by an unusual amount of minor legislation of more than ordinary importance to the business world. Such bills as the trust and loan companies acts, safeguarding the incorporation and running of such institutions, are examples. The bill to

prohibit deceptive advertising is another measure of this character. Another bill, affecting, of course, only the manufacturers of matches, was that prohibiting after the end of this year the use of white phosphorus in their manufacture.

Saturday, another bill of interest passed, that proposing to regulate the manufacture, testing, storage and importation of explosives. In recent years there has been great growth in the use of explosives, and their varied manufacture has become an important industry. There have been a number of serious accidents in Canada, and the new bill will provide greater safeguards.

This has indeed been a business session, and perhaps none for years has contained so many measures of importance to business, financial and commercial interests. The tariff was one of more than ordinary importance. This week or next at latest will see the close of the C. N. R. debate. The Government proposals have already been outlined and they will go through without serious objection, it is believed.

St. John, N.B., May 16, 1914.—The plant of the Maritime Cornmeal Mills in Erin street was almost totally destroyed by fire this week at a loss of about $6,000. The plant will be rebuilt, and it is probable that there will be an enlargement of the industry.

The Canada Wire & Nail Co., Ltd., a local manufacturing concern have made application to the city council for certain concessions in connection with their proposal to establish a plant for the manufacture of horseshoe nails on the site of the former Gordon Nail Works, West St. John. The company offered to lease the land for twenty-one years and asked for a limitation of taxes to an annual amount of $200 for ten years. An answer to the company's proposal has been promised for next week.

A visitor to St. John this week was W. Macdonald Mackintosh, a former resident of Liverpool, Eng., who is the inventor of a mixture which transforms fine quality silk goods or heavy duck into waterproof material. He has already formed a company for the manufacture of waterproof garments in the States, and proposes to do the same here, or in some other town in the Maritime Provinces. He was favorably disposed towards St. John, he said, but intended to look over certain other sites in Maritime cities before deciding as to where he would build his plant. He went to Halifax from St. John.

Another large pulp mill is to be erected in New Brunswick, in addition to the pulp and paper mill of the Bathurst Lumber Co., at Bathurst. The plant of the New Brunswick Pulp & Paper Co., at Millerton was closed down a few days ago pending a reorganization of the company and the rebuilding and re-equipment of the plant to enter the news-print field. The old company's creditors have been paid in full. J. L. McNichol, general manager of the company, said this week that London and New York capitalists were interested in the plant to quite an extent and it was planned to make it one of the most up-to-date and modern in Canada.

A delegation of local members of the Board of Trade returned home this week from Montreal, where they interviewed Sir Thomas Shaughnessy with regard to the possibilities of trade for St. John during the next winter. He told them that the facilities at St. John would have to be improved and he urged the delegation to exert its power to expedite wharf construction on the west side. While in Ottawa they interviewed members of the Cabinet.

W. Manning Doherty, general manager of the Maritime Dredging Co. made the statement this week upon his return from Montreal that the two new wharves which his company was constructing at Sand Point would be ready for steamers by December 1. The filling for the sites for the sheds will be completed by August 15, and the contracts can be let immediately. This would give plenty of time for shed erection.

Winnipeg, Man., May 18, 1914.—Reports from manufacturers, wholesalers and retailers in Winnipeg indicate that there is a steady, but moderate increase in the movements of merchandise. The outlook is considered favorable. It is expected that warmer weather will be followed by an active demand for goods to replenish stocks throughout the country.

Building permits continue to grow at a surprising rate in Winnipeg, and if builders and contractors can get all the money they require, there seems to be no doubt that there will be great building activity during the summer. It is said, however, that the volume of loans on city property this season to date is far short of the proportions that building permits indicate.

Money is reported fairly plentiful, but there is undoubtedly a tendency to place it cautiously, and most of the leading companies are quoting firm rates. The loaning of money on farm property is in moderate volume. There is a tendency to restrict speculation this year in practically all parts of the West. It is said that the farmers in some parts of the West have recently been paying mortgages in a satisfactory way.

Collections generally are not as good as the trade expected. There is a considerable demand for money for municipal improvements throughout these provinces, and it is said that several million dollars of bonds have been purchased.

Calgary, Alta., May 14, 1914.—Machine shops and manufacturers in Western Canada are buying tools and steel much more freely than they did three or four months ago. Whereas some plants were closed down at that time, the majority of them are now running full time, and while some are still working on stock, orders are coming in freely, and they are pretty sure of disposing of the stock they are making in the near future.

Those manufacturers who are able to supply tools, etc., and are willing to receive payment over a period of one or two years, are making big efforts to secure such business as is offering. Some of the large eastern houses are offering terms that two years ago would have been unthinkable, while others who have been "stung" on risky Western propositions are leaving business of this nature alone.

The representative of a Sheffield tool steel firm stated that there was no fault to find with that end of the business, he having had to cable to England four times in a very short period for extra supplies. Garages are buying much better, and several new plants scattered throughout Western Canada will be in the market soon for machinery equipment. A steel concern is proposed for Vancouver, backed by prominent financiers, and a firm manufacturing bakers' equipment will commence the erection of a plant there of considerable size in Vancouver shortly.

Building in Winnipeg is going ahead at a great pace, the value of permits having exceeded the five million mark, which is a record for the Prairie City. In Edmonton, which is one of the busiest cities in the West at the present moment, several large buildings are under construction. Considerable activity is also being displayed in the country north of Edmonton. In Calgary, building is not so brisk, though a large post office is going up.

E. Laurie Co., 240 Bleury St., Montreal, have been appointed agents of the Hare Engineering Co., for the Province of Quebec.

The Canadian Niagara Linens, Ltd., of Niagara Falls, Ont., have recently been incorporated with a capital of $300,000. The general manager is Mr. A. Fergusson Macintyre, formerly with the Montreal Cottons, Ltd., Valleyfield, Que. The mill will be approximately 208 ft. square, and it is expected that the machinery will be purchased early in July.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

$15,000,000 OIL PURCHASE.

PARTICULARS of a big oil merger which has just been closed by Earl Grey, as chairman of the Board of Directors of the British Union Oil Co., was announced a few days ago by Alexander Sclater, vice-president of the Union Oil Co. of California, on his arrival from San Francisco, via Victoria with his lordship, who is traveling incognito.

The British Oil Co., one of the largest oil corporations in the world, owning some of the principal oil concessions in Mexico, through Earl Grey has purchased the majority of the stock in the Union Oil Co. of California, a consideration of fifteen million dollars being involved in the transaction. This gives the British company control of some of the largest and most important oil wells in California in addition to its already considerable holdings.

The General Petroleum Co. of California has also been bought out by British interests represented by Earl Grey. Negotiations towards a big combination of forces have been in progress for some time and Earl Grey on his way across the Pacific on a world-girdling tour, visited California to look over the properties and consult with the heads of the Union Oil Co. before completing the deal.

NEW TECHNICAL SCHOOL FOR EDMONTON, ALTA.

THAT opportunities for technical education are needed equally as much on the south side of the river as they are on the north and that immediately these opportunities are provided the south side school containing them will be filled with students, was the information furnished members of the public school board by W. L. Richardson, Edmonton's director of technical training, at a meeting held on April 20.

It is proposed to use the old King Edward school on the south side for technical education purposes, and in accordance with a previous resolution, Mr. Richardson addressed the meeting concerning the proposed work, and the equipment required. The report was laid on the table to be further considered at the next session of the board, while Mr. Richardson was requested to submit a further statement as to the staff needed for this new branch.

Study Features.

(A)—Woodworking, joinery, cabinet making, carpentry and building construction.—Two rooms and a hall on ground floor.

(B)—Mechanical, machine and architectural drawing. — Assembly room, third floor.

(C)—Art and applied design, and clay modeling.—One room, third floor.

(D)—Sewing, dressmaking and millinery.—One room, second floor.

(E)—Cooking.—One room and office, second floor.

(F)—Bookkeeping, shorthand, and typewriting.—One room on second floor.

(G)—Gas engine and elementary electrotechnics.—One room in basement.

(H)—Academic work in both day and evening classes related to the occupations of technical and industrial workers. —One room on ground floor and one room on second floor.

Equipment Features.

The equipment required for the foregoing work will consist of:—

(A) — Sixteen cabinet maker's benches; one joiner; one universal saw bench; one band saw; one mortiser; one grinder; four pattern-maker's lathes and the necessary hand woodworking tools.

(B)—Twenty drafting tables, twenty stools, sixty drafting boards, twenty sets drafting instruments, twenty T-squares, twenty set squares, twenty scales.

(C)—Ten easels, ten stools, casts, etc.

(D)—Eight tables, twenty chairs, six sewing machines, one mirror, one dress form, one skirt marker.

(E)—Ten double cooking tables with cupboards and drawers underneath, twenty electric stoves, one coal range, one fireless cooker, one teacher's demonstration table, two supply cupboards, one refrigerator, twenty individual sets cooking utensils, additional cooking utensils for general use.

(F)—Ten typewriting machines, ten tables, ten chairs.

(G) Various types of modern gas engines and parts, elementary electricial apparatus.

(H)—Desks and seats for fifty pupils and the usual equipment of teachers' desks, chairs, bookcase, maps, etc.

It is expected that some of the apparatus will be loaned by various public-spirited business firms in the city for the purpose of demonstrating in the school, while the desks and seats are already in the school. Apart from these the equipment listed above would cost approximately $9,500.

WESTERN CONDITIONS SHOW IMPROVEMENT.

Mr. J. S. Dennis, assistant to the president of the Canadian Pacific Railway and head of the department of natural resources of that Company, on his arrival in Montreal from the west on May 16, said business both in the railway line and in the cities and towns of the west is quiet but improving owing to the fine spring and the early movement of people westward. It is now very generally recognized that following the extraordinary development experienced in all the Western provinces of Canada during the past few years, resulting as it has in the rapid growth of urban centres, there must naturally be a period of check in this class of growth until the settlement and development of the agricultural areas catch up. The inflated conditions of business and speculative dealing in real estate, which always accompanys rapid development in a new country, have now passed, and the progress which is being made is on sound lines.

DOMINION STEEL CORPORATION FIGURES.

NET earnings of $1,854,825, or, after deductions, slightly under $2\frac{3}{4}$ per cent. on the common stock is the outstanding feature of the annual statement of the Dominion Steel Corporation, the profit and loss account of which was made public on May 14. Net figures show a falling off of $517,842 from the level of the previous months ended March 31, 1913, a decline of 21.82 per cent., the earnings for year 1912-3 being $2,372,667, representing 4.3 per cent. on the outstanding common stock of corporation.

Net profits for the fiscal year ended March 31 are barely in excess of those at the same date in 1912, the increase over the latter period being a scant $19,656. A decrease in manufacturing profits of $272,026 from the level of the previous year, combined with an increase of $351,578 in bond interest requirements, are the chief factors in poorer showing.

New Financing.

New financing is responsible for heavier financial obligations in the latter respect. The showing in the main is distinctly disappointing. Although it was a matter of common knowledge that the Corporation's business was at a low ebb during the final quarter of the

year, it was generally thought earnings would show an equivalent to slightly less than four per cent.

Earnings for the first quarter of the year were well over 6 per cent., which shrank to 5.6 per cent. at the end of the third four-monthly period.

Statement in Detail.

The profit and loss statement issued to-day shows the following:

Manufacturing profits $4,442,031, less depreciation, etc., $903,889, and less bond interest and discount, $1,683,317, leave net earnings as $1,854,825. This added to balance April 1, 1913, of $883,012, less preferred dividend $980,000, less common dividends $960,931, leaves balance at balance March 31, 1914 of $796,907.

An allowance of $903,889 for sinking funds, exhaustion of materials and general depreciation compares with $1,009,660 in the previous year, or $105,761 less. A marked increase in interest charges which grew from $1,331,739 in 1912-3 to $1,683,317 last year, is of equal importance in showing poor business conditions under which the company operated.

INTERESTING POWERS GRANTED TO A COMPANY.

FEDERAL incorporation has been granted to a new Toronto company under the name of "Employers' Detective Agency, Limited," with a capital stock of $100,000. The powers granted are decidedly interesting. The company may go into the business of obtaining and furnishing all kinds of information about individuals, corporations, etc.; it may enter into arrangements with governments or authorities, supreme municipal, local or otherwise, which may seem conducive to the company's objects, and it may remunerate any person for services rendered in assisting to place or guarantee securities or debentures, etc. The last-mentioned powers are interesting, in view of the strictures passed in Parliament by Messrs. Bennett and Nickle on the growing evils of the Parliamentary lobby.

AUSTRALIAN CABLE RATES REDUCED.

A GREATLY reduced cable rate for week-end messages, subject to slight delay, has been arranged between Canada and Australia and New Zealand. The announcement was made on May 16 by Hon. L. P. Pelletier, Postmaster-General, who has been negotiating with the British and Australasian postal authorities in connection with the proposals for a cheaper week-end rate over the State-owned cable.

The new rate, which goes into effect forthwith, provides for week-end messages from Canada to Australia and New Zealand at $2.80 for the first twenty words or less, and 14 cents for each additional word. The regular cable rate between points in Canada and Australia is now 58 cents per word. The new rate for deferred messages is only 14 cents. The week-end messages sent at the new rate may be subject to a delay of 24 to 48 hours, but the arrangement should be of material advantage to business men or others where a comparatively short delay will not matter.

NEED FOR PAUSE.

IN an editorial on "Railway Subsidies," on May 19, the London Times suggests that not much political importance should be attached to the outburst in Canada of hostility to the Canadian Northern contract. The giving of subsidies or guarantees is a sound method of facilitating the equipment of new countries with railways, provided the authority for granting them is really capable of making efficient investigations into the plans submitted and is free from improper influences.

In practice, Parliamentary bodies in new countries are not all that could be desired in either respect, but the errors are more often attributable to an excess of enthusiasm for rapid development than to sinister motives. Several of the Western Provinces, if not the Federal Government of Canada, have recently done rather more than was strictly prudent in this matter of railway guarantees, and it will not be a bad thing if the debates on the Canadian Northern subsidies should lead to a pause.

DOMINION STEEL REPORT.

THE serious decline in orders, and the consequent partial shutting down of the plants, coming at a time when all supplies had been laid in for an active winter's operations, have brought about a condition where we hold an excessive amount of raw and manufactured material, with a consequent increase in our current liabilities. The interest charges due with this, together with the charges on the entire cost of the new plant, which now falls on the earnings, but from which as a whole little benefit has yet been derived, have reduced the balance of earnings available for dividends."

In the foregoing paragraph, Mr. J. H. Plummer, president of the Dominion Steel Corporation, sums up the company's position in the annual report, which was mailed to shareholders a few days ago. With regard to current liabilities, the balance sheet accompanying the report shows a total of $6,005,965, as compared with $6,908,396 last year. Loans and accounts payable stand at $5,476,940, as compared with the corresponding total of $6,122,679 a year ago. On the side of current assets, there is a total of $9,527,568, as compared with $7,860,125 a year ago. That is to say, whereas there was a surplus of current assets over current liabilities of $951,729 last year, the surplus this year stands at $3,521,603, a difference of about $2,600,000. Inventories, as Mr. Plummer indicates, are up sharply, totaling $6,904,477, an increase of more than $1,900,000. Accounts receivable are about $375,000 lower, at $2,363,356.

In course of the report, Mr. Plummer says: "When the directors met you at the last annual meeting prosperous business for the year was confidently looked forward to, and for the first half of the year the expectations of your directors were realized. In the autumn a severe depression in the iron and steel business set in which affected your business for the rest of the year, and especially for the last quarter, most seriously."

Regarding plant additions, Mr. Plummer states that the expenditure incurred on the steel plant covered the completion of the extensions which have been in progress for some years. The directors have discontinued as far as possible all new expenditure of this kind, and on the steel plant it has for some time practically ceased. The capital expenditure of the subsidiaries last year amounted to $1,759,036, of which $1,123,599 was expended on the new collieries and other property improvement connected with the coal business, and the balance on the steel plant, mines and quarries.

Regarding manufacturing and business conditions, Mr. Plummer states that the dullness in the coal trade in the fall and winter months has not affected the prospects for the coming year. The normal output of coal will be maintained, and no decrease in sales and prices is expected.

FUNERAL OF WILLIAM WAINWRIGHT.

ONE of the most impressive funerals in the history of Montreal took place on May 18, when the remains of the late William Wainwright were laid to rest in Mount Royal Cemetery. The simplicity of the ceremony only added to the import of the occasion.

At two o'clock the Grand Trunk official family, which included not only the officials at headquarters, but those from many parts of the system, met at the Windsor Hotel and marched in twos to the family residence on Metcalfe Street. Thence at 2.30, when every wheel on the system had ceased for sixty seconds, the cortege proceeded to the Church of St. James the Apostle.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Hagersville, Ont.—Extensions to the hydro-electric system are being considered.

Biggar, Sask.—The town are in the market for a deep well pump and cast-iron pipe.

Vernon, B.C.—An electric light system will probably be installed at Peachland at a cost of $1,000.

Little Current, Ont.—A by-law will shortly be voted on to raise $12,000 for the installation of a power plant.

Aylmer, Que.—An electric pumping plant will probably be installed in connection with the waterworks system.

Grenfell, Sask.—Permission has been granted the Town Council to raise $6,500 for extensions to the electric light plant.

Renfrew, Ont.—The Hydro-Electric Commission have submitted a revised estimate for completing the lighting of the town. The total cost is estimated at $16,000.

Oshawa, Ont.—The Vanstone-Read Manufacturing Co., of Toronto, have bought the Stacey Factory here and will install machinery for making steel locks, hinges, etc.

Preston, Ont.—The Car and Coach Co. contemplate putting in a sprinkling system. Mr. D. M. Campbell, general manager, was in Toronto a few days ago looking into the merits of the "Silent Watch" system. By this system the fire is extinguished by chemicals.

Port Coquitlam B.C.—Arrangements are now practically complete between a Vancouver syndicate of capitalists and the Coquitlam Terminal Co., for the establishment of a steel rolling mill in this city, the site for which is to be on Pitt river adjacent to the plant of the Coquitlam Shipbuilding and Marine Railway. Mr. Leon Melekov of Vancouver is interested.

Sarnia, Ont.—The City Council have decided to purchase a steam road roller at a cost of $2,800.

Edson, Alta.—The town will install an electric lighting and power system at an estimated cost of $45,000.

Coquitlam, B.C.—A waterworks system will probably be installed at the western section of the municipality.

Goderich, Ont.—The Town Council have decided to install a firm alarm system at an approximate cost of $1,000.

Galt, Ont.—Norman L. Wilson, inspector for the Fire Underwriters' Association, has reported in favor of enlarging the reservoir and increasing the water supply for the city.

TO WHOM IT MAY CONCERN.

The Canadian Kodak Company has decided to start work immediately on the erection of a new plant at Weston, Ont., where the company purchased a 24-acre lot last fall. The new plant will cost $1,500,000 and is planned to meet both English and Canadian demands, and to take advantage of the low British tariff on the raw materials the Eastman Co. needs. Seven buildings will be erected, with a floor space of 11 acres.

Windsor, Ont.—To give a better supply of natural gas the Windsor Gas Co., which supply the city, will co-operate to lay a new main from the fields at Tilbury at an estimated cost of $200,000. The pipes to be laid will be 18-inch and the length 22 miles.

Watford, Ont.—F. W. Thorold, consulting engineer, of Toronto, has submitted an estimate to the Town Council on the cost of installing a water works system. The estimated cost is $36,400, which includes a pump house, pumps, stand pipe and mains.

Municipal

Tara, Ont.—The council will probably buy a fire engine.

Saskatoon, Sask.—The by-law for a fire alarm system which was recently turned down by the ratepayers will be voted on again on June 5.

Saskatoon, Sask.—The ratepayers will vote on June 14 on a by-law to authorize the raising of $15,000 for a site for the proposed power house. The by-law was turned down on May 1, but a by-law for a power house was passed on that date. If the by-law is defeated a second time, the site will have to be purchased out of current funds, which at the present time is undesirable.

Transcona, Man.—A vote of the electors of Transcona will be taken May 23 on a by-law authorizing the Town Council to borrow $25,000 for the purpose of paying for the installation of an incinerator plant. On the same day also, the electors of Transcona will be asked to express their approval of a by-law authorizing the borrowing of $100,000 for installing a sewerage system. A third by-law will be presented for approval on this date, to empower the council to borrow $115,000 for installing a water works system and fire protection.

Owen Sound, Ont.—A special meeting of the Town Council took place on May 12, at which three industrial propositions were discussed and passed on to the ratepayers, who will vote on them on Saturday, June 6th. A dry dock and shipbuilding concern is to be given a bonus of $10,000 per year for twenty years. It is to construct a plant to cost $1,500,000, and to give employment to not less than two hundred men for at least eleven months in the year. This measure met with no opposition from the Council. The Union Cement Company gives the town a first mortgage on its plant and property, in return for which the town is to give a loan of sixty thousand dollars, to be repaid, principal and interest, in ten equal annual instalments. The concern is to employ sixty-five men for nine months in the year. The Canada Yeast Company has asked for exemption from taxes for a term of ten years.

General Industrial

Haileybury, Ont.—The Harris abattoir building was destroyed by fire recently. Loss $1,200.

Thamesville, Ont.—The Thamesville Canning Co. have sold their plant to the Thames Canning Co.

Stoney Creek, Ont.—It is reported that a company which is a large producer of fire clay in Ohio will establish a plant here.

Oakville, Ont.—It is reported that the basket factory has changed hands and that the new owners will make extensions to the plant.

Port Colborne, Ont.—The Niagara Feed and Seed Co. have commenced

work on the foundations for their new factory near the Government elevator.

Montreal, Que.—The city council has decided to purchase two motor patrol-wagons, one motor ambulance and three motor cars.

Medicine Hat, Alta.—It is reported that the Maple Leaf Milling Co. are making arrangements to begin construction next week on their new plant here.

Toronto, Ont.—It is announced that Mr. F. B. Robins will operate a service of motor 'buses from Yonge Street through a new sub-division to Bathurst Street.

St. Boniface, Man.—The Western Tire and Rubber Co. will probably build their new factory here instead of at Regina, as originally intended. The factory will cost $175,000.

Oak Point, Man.—A party of engineers have completed the survey of the spur to be put in about two miles north of here. A large plant for limestone and crushed stone will be installed.

Sutton, Que.—Clark Bros. have sold their tub making machinery in their factory here to the company at D'Israeli on the Q.C.R. and will give up making butter tubs when their present stock of spruce is worked up.

Estevan, Sask.—The Great West Brick and Coal Co. will proceed with the building of their kilns. The machinery will be supplied by the George E. Snowdon Co., of Hammond, Va., and by the J. D. Tate Machine Co., Plymouth, Ohio.

Ottawa Ont.—The Government has decided to locate in Victoria the new 72-inch reflecting telescope which is to be the largest in the world. It will cost around $200,000. Victoria has been selected because of its superior climate and its lengthened period of clear skies.

Sherbrooke, Que.—The J. H. Hamilton Shoe Co. by-law passed its third reading at the special meeting of the City Council recently. Under the provisions of the by-law the building is to cost not less than $20,000 and the plans and specifications are to be approved by the Council.

Regina, Sask.—The Board of Trade has announced that negotiations have been completed for the establishment in Regina of a red brick plant, which will turn out daily between 50,000 and 100,000 bricks, and employ from thirty-five to sixty men. It is expected that the plant will be in operation by July.

Redcliff, Alta.—The following local concerns have decided to open sales offices in Calgary and Edmonton, under the supervision of Mr. E. Byrnes:—The Redcliff Ornamental Iron Works, Redcliff Pressed Brick Co., Redcliff Rolling Mills and Bolt Foundry, Redcliff Motors Co., and the H. Kelly Co., of Minneapolis.

Sherbrooke, Que.—Three by-laws will be submitted to the ratepayers on May 26, namely, the J. H. Hamilton by-law providing a bonus for the proposed shoe factory; the Canadian Rand by-law providing for a fixed valuation of $100,000 for municipal purposes; the C. P. R. by-law providing for a fixed valuation of $50,000.

Embro, Ont.—Libby & McNeill, of Chicago, a subsidiary of the Swift Company, are considering the establishment of a branch plant here. Representatives of the big firm have been in the village, and the Board of Trade is hopeful of securing the industry. The oatmeal mills, formerly operated by D. R. Ross and the Cereal Milling Co., may be purchased for the purpose.

Stratford, Ont.—Of four by-laws voted upon by the ratepayers on May 18, three were carried. The fire apparatus measure, asking $17,250 for new fire equipment, which is badly needed, was defeated, the vote being 454 for and 622 against. In connection with this by-law a question was submitted as to the ratepayers' preference for motor-driven or horse-drawn apparatus, and the answer was: For horses, 470; for motors, 461. The by-law to provide $11,500 for an incinerator as the disposal feature of the proposed garbage removal system was the most strongly indorsed of all, being carried by 604 to 476, a majority of 128. By 574 to 505, the citizens voted $22,000 to install nitrogen-filled lamps on iron poles in the business centre of the city, and extend the present lighting facilities into the outskirts. The third successful by-law provides $10,000 to complete the Agricultural and Athletic Park by adding stables, fences and track. A very light vote was polled, there being no organized effort to get the citizens to the polls.

Trade Gossip

The Frick Co., Waynesboro, Pa., have supplied a 10-ton vertical refrigerating machine and brine cooling system for the Earnescliffe Apartments, Toronto, Ont.

The Frick Co., Waynesboro, Pa., have supplied to the order of Keiths, Ltd., Toronto, a 15-ton vertical refrigerating machine and compression system with brine cooling apparatus.

Shops Slow Down.—After working on a 55-hour a week basis for several weeks in making repairs to locomotives, the machine shops of the Pennsylvania Railroad at Altoona have resumed the 40-hour a week basis.

Overtime in Hamilton Factories. — Several of the large manufacturing concerns in the east end of Hamilton, have started to work overtime. The officials of the Steel Co. of Canada, report that business is picking up, and they expect to have their plant working at full capacity again soon. The Canadian Westinghouse Co. also reports improved conditions.

The Wells Bros. Co. of Canada, Ltd., have taken over the business formerly carried on by the Canadian Tap & Die Co. at Galt, Ont., the local management remaining as before. This step has been taken to prevent confusion among customers over tools bearing the trade mark "Little Giant," which have heretofore been made in the United States by Wells Bros. Co., and in Canada by the Canada Tap & Die Co.

April Fire Losses.—The fire loss of the United States and Canada for the month of April, as compiled by the New York Journal of Commerce, shows a total of $17,700,800. The following table affords a comparison of the losses by months this year with those of the same months in 1913 and 1912, together with the monthly record for the balance of those years:—

	1912.	1913.	1914.
Jan.	$35,653,150	$20,193,250	$23,204,700
Feb	28,601,650	22,084,600	21,744,200
Mar.	16,650,850	17,511,000	25,512,750
Apr.	16,349,400	16,738,250	17,700,800
Tot.	$97,255,050	$76,528,100	$88,162,450

Refrigeration

Medicine Hat, Alta. — The Medicine Hat Pure Ice Co., recently organized is we understand, preparing to erect a 50-ton ice making plant.

Hagersville, Ont. — C. W. Kaufman has had his creamery equipped with a 4-ton refrigerating machine furnished by the York Mfg. Co., York, Pa.

Victoria, B.C. — The Brentwood Bay Hotel Co. are having their hotel equipped with a 2-ton refrigerating machine, furnished by the Triumph Ice Making Co., Cincinnati, O.

Regina, Sask.—It is reported that Alex. Harrison of Minneapolis will erect an ice factory and cold storage plant here this summer. The plant will cost approximately $50,000.

Brantford, Ont. — Ryerson Bros., wholesale grocers and produce merch-

ants, have installed a 4-ton vertical refrigerating machine furnished by the York Mfg. Co., York, Pa.

Collingwood, Ont. — T. Long & Co., Ltd., wholesale produce merchants, have equipped their cold storage warehouse with a 17-ton refrigerating machine, furnished by the York Mfg. Co., York, Pa.

Saskatoon, Sask.—The Saskatchewan Co-operative Abattoir & Cold Storage Co., has been organized to establish an abattoir and also a cold storage warehouse, a Government subsidy for which has been requested.

Hays Port, B.C.—The Skeena River Fisheries, it is reported will build an addition to its cold storage plant at a cost of about $50,000. The plant now has a cold storage capacity of about 2,000,000 pounds.

Kingston, Ont.—J. Y. Parkhill & Co., Ltd., dealers in groceries and produce, have fitted up cold storage rooms and installed a 4-ton refrigerating machine furnished by the York Mfg. Co., York, Pa.

Edmonton, Alta. — The New Grand Trunk Pacific Hotel is being equipped with a 20-ton refrigerating machine and a 3-ton ice making system, machinery for which was furnished by the Triumph Ice Machine Co., Cincinnati, O.

Catalogues

Boiler Cleaning Logic.—A pamphlet devoted to the treatment of external surfaces of steam boilers and published by the Bayer Steam Soot Blower Co., St. Louis, Mo., has reached us. The "Bayer" soot blower system is described fully and its application clearly shown by means of a number of illustrations. The pamphlet also contains several copies of testimonials and partial list of users.

Reducing Valve and Pump Governor.—Bulletin No. 9, issued by the C. A. Dunham Co., Toronto, deals with the "Fisher" reducing pressure valve and vacuum pump governor. A comprehensive description is given of these fittings, with tables giving the weight, price and code word for each size. Diagrams are included for each fitting, with the name of each part given, while one table gives the principal dimensions for each size of pressure-reducing valve.

The Bayer Feed Water Purifier is treated at length in an attractive bulletin sent to us by the Bayer Steam Soot Blower Co., St. Louis, Mo. The feed water problem is discussed and the claims for the "Bayer" purifier set forth, followed by a complete description of this apparatus. One page is devoted to boiler troubles, their causes and remedies. Tables of evaporation and coal consumption are also included. The bulletin is fully illustrated to show the application of the "Bayer" purifier.

The Electric Storage Battery Co., Philadelphia, Pa., have issued hand-book HL descriptive of low voltage isolated electric plants for lighting and power with chloride accumulators. Particulars are given of the plant and system, with illustrations of switchboards and wiring diagrams. A complete list of equipment and material contained in each plant, including the accumulators, is also given, with price list, capacity and shipping weights. Copies may be obtained from the Canadian General Electric Co., Ltd., Toronto.

Chloride Accumulators, made by the Electric Storage Battery Co., Philadelphia, Pa., are described fully in hand book IP sent us by the Canadian General Electric Co., Toronto. The accumulators dealt with in this catalogue are for use in 110 volt isolated power plants only, those of higher voltage being listed in other catalogues. The different types are dealt with separately, and a complete list of material contained in each equipment is given, together with prices, capacity and shipping weights. A number of switchboard specifications are included with diagrams showing connections.

ASSOCIATION AND PERSONAL

A Weekly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Machinery Circles

Paul Mercier has been appointed assistant to the chief engineer of Montreal at a salary of $5,000.

R. S. Lea, of Montreal, has been appointed consulting engineer of the municipality of Fort Garry, Man.

Hon. F. D. Monk, former Minister of Public Works, in the Dominion Cabinet, died at Montreal, on May 15, aged 58.

R. E. Armstrong has been appointed secretary of the Board of Trade, and industrial commissioner for St. John, N.B.

Cyrus A. Birge, vice-president of the Steel Company of Canada, has been elected vice-president of the Bank of Hamilton.

L. M. Wood has been appointed president of the Standard Chemical, Iron & Lumber Co., to succeed Colonel A. G. Peuchen, resigned.

William McNab, principal assistant engineer of the Grand Trunk Railway System, has been elected president of the Canadian Railway Club, Montreal.

Oscar Mueller, president of the Mueller Mfg. Co., Sarnia, Ont., was elected president of the American Waterworks Association at the recent meeting in Philadelphia.

Captain Andrew Rattray died at Detroit, Mich., on May 9, aged 72. Captain Rattray was until his retirement two years ago, in the service of the Detroit & Windsor Ferry Co.

B. W. Greer has been appointed agent for British Columbia for the Maple Leaf line of steamers, which ply between New York and Vancouver. His headquarters will be Vancouver.

Captain Andrew Baird died at his home in Toronto on May 12, aged 80. Captain Baird was at one time one of the best known captains on the Great Lakes, but retired 20 years ago.

George Kidd, of Vancouver, has been appointed general manager of the British Columbia Electric Railway in place of R. H. Sperling, who goes to London to be assistant to the chairman of the Board of Directors.

Alexander B. Scully, president Scully Steel & Iron Co., died May 7 at his home in Chicago, aged 58 years. He was born in Chicago, and in 1891 formed the Scully-Castle Co., which later became the Scully Steel & Iron Co., of which company he was president up to the time of his death.

Dr. Paul Louis Toussaint Héroult, a pioneer in the electrometallurgy of aluminum and steel, died in France, May 9, from an attack of typhoid fever. While he had not enjoyed good health for some time, his death at the age of fifty-one was hardly expected.

Admiral Sir Charles Carter Drury, G.C.B., G.C.V.O., K.C.S.I., F.R.G.S., who was Second Sea Lord of the British Admiralty from 1903 to 1908, died on May 18. Sir Charles, who was born at Rothsay, New Brunswick, in 1846, was educated at the Collegiate School, Fredericton, N.B. He entered the Royal Navy in 1859, and became an Admiral in 1908. He was Commander-in-Chief at the Nore, 1908-1911, when he retired from the active list.

William Wainwright, senior vice-president of the Grand Trunk and Grand Trunk Pacific Railways, died at Atlantic City on May 14. Mr. Wainwright was born in England in 1840, and came to Canada in 1862, when he entered the service of the Grand Trunk Railway, and remained with the company until his decease.

F. P. Gutelius, general manager of Government railways, was hurt on May 14, in Montreal, by falling from a street car whilst on his way to the station to catch the 7.30 I.C.R. Ocean Limited. He attempted to board a car, and failing to get proper hold, was dragged several yards, sustaining painful injuries to the face. He was taken to the General Hospital, where it was stated he would have to remain several days. His injuries though painful, are not severe.

Canadian Electrical Association Convention.—The annual convention of the Canadian Electrical Association will be held this year in Montreal on June 24, 25 and 26. The headquarters of the convention will be in the new club rooms of the Canadian Society of Civil Engineers, Mansfield street. At a recent meeting of the executive branch, committees were formed including a convention committee of Montreal men, a committee in Toronto to co-operate with them, a papers committee, etc.

Edmonton Branch, Can. Soc. C. E.—On May 1 an Edmonton branch of the Canadian Society of Civil Engineers was formed, with headquarters at the University of Alberta. Fortnightly meetings will be held. The following are the officers elected for the ensuing year:—Chairman, W. Muir Edwards, M.Sc., C.E., Professor of Civil Engineering, University of Alberta; secretary-treasurer, L. B. Elliott, Department of Public Works, Canada. Executive Committee—Commissioner of Works, J. Chalmers; W. R. Smith, N. M. Thornton, D. J. Carter, J. D. Robertson, and R. H. Parsons.

Wilson B. Chisholm, president Champion Rivet Co., Cleveland, Ohio, died May 10, aged 65 years. He had been in poor health for a number of years, following a stroke of apoplexy, and during that time had practically retired from active business. He was born in Montreal, Canada, and when a boy his father, Henry Chisholm, moved to Cleveland. The latter was one of the founders of the Cleveland Rolling Mill Company, of which his son, Wilson B., was vice-president and manager for about 15 years. He was also interested in the Chisholm & Moore Mfg. Co., Cleveland, of which his brother, S. H., is president.

J. E. Rogers, until recently assistant general sales manager of the National Cash Register Company at Dayton, O., joins the Russell Motor Car Co., as assistant general manager. Mr. Rogers will also be elected to the directorship made vacant recently by the death of the late Senator Cox, and becomes second vice-president of the company. Mr. Rogers is a Canadian, born at Barrie, Ont. Previous to joining the National Cash Register Co., he was on the staff of the Canada Cycle & Motor Co., in charge of their Toronto retail branch, and before that time represented the Gould Bicycle Co. in the Maritime Provinces. He assumes his new duties at once.

Col. H. N. Ruttan, who has been for many years city engineer of Winnipeg, will, we understand, be relieved of his duties on June 1. Col. Ruttan's resignation has not been entirely unexpected; in fact, it was intimated last year that he contemplated resigning at an early date. The death of R. D. Willson, assistant city engineer, delayed the matter, however, and he was induced to continue in office for some time longer. Col. Ruttan is not completely severing his connection with the city, it being understood that he will be retained as consulting engineer at a salary approximating that which he receives as city engineer.

How May Employer and Employee Earnings Be Increased?*

By J. C. Spence**

The author, on the assumption that competitive conditons will in the future be very much as at present existing, expresses the opinion that the only method whereby the personnel of the machine tool industry on this continent can be kept in the highest class is by the offering of greater wage inducements. The mere act of holding a job has ceased to be the all-important factor.

THE record of the recent past, and the known evidences as to the immediate future point out the fact that if the machine tool industry of this continent is to compete for the best class of workmen, there must be a change in our methods. Competition with Europe and with each other precludes the possibility of any great increase in the selling prices of our products.

The changes, then, must happen within our organizations: we must get more saleable goods per dollar of investment, and this result must be attained, not by a decrease in the earnings of all concerned, but by an increase, else we will gradually lose the best of our men to such other industries as have, at present, a larger margin of profit. This movement has already made inroads into the field of good machinists, and every one of you is familiar with the statement that "we can't get the kind of man that we could some years ago." This lack of good men is, of course, not due entirely in our line, to the fact that other industries are offering better opportunities, but is more or less influenced by the fact that the growth of industry in general is faster than the supply of trained men would warrant. Nevertheless, it is a known fact that one industry in particular is taking from us many of our brightest young men, and is taking them almost entirely because of wages.

Employers Blameworthy.

Whenever the word efficient or inefficient has been used as applying to our line of work, the natural tendency has been for all minds to turn to the shop end of the business, especially to the man who runs a machine. Practically all of the illustrations by means of which our eminent experts have arrested the attention and gained a permanent lease of the ears of managers and boards of directors, have had to do with such perfectly awful incidents as a shaper tool taking a 5-in. stroke when a 3⅝-in. stroke would have been sufficient. I hold no brief for the man who cuts air when he should cut metal, but to my mind it is no more than right that we should first look to ourselves to see wherein we fall short of the mark of 100 per cent. If the workman be not efficient just what is our share of the cause of his inefficiency?

First, let me say, that it is my firm belief that the large majority (if I were to state a percentage I would say 70 per cent.) of all machinists employed by members of the National Machine Tool Builders' Association, are endeavoring to give you an honest day's work. That they do not give you more work than at present is largely your fault—so much your fault that it is going to take the whole of your attention to certain details before you can induce your men, and hence yourselves, to earn more money.

I am saying this from a mind that only a comparatively few years ago looked at the workman's side, only, of this question. I am not so far away from the operation of a machine that my memory has become dulled to what went on when I was trying to produce in face of obstructions which were allowed to stand in my way by my foreman and by his superiors. The metal cutters or chip makers on the simpler class of work may be assumed to be fairly efficient in most of our shops, and it has been a comparatively easy matter to set standard times or prices on these operations.

GETTING THE MAN INTERESTED.

You've got to get the man interested, and there's only one way—put him into "business for himself." How this is to be done, whether by premium or piecework, matters little, provided you see to it that more product means more wages There is just this much about it—those of you who stick to a straight day work system, unless you devise ways of periodically rewarding increased efficiency, will lose your men to the shops that succeed in putting every man in 'business for himself."

Shop Drawings Lacking in Instruction.

There is still a good field for improvement in the making of drawings, especially for the workman's use. I'll venture to say that in every one of our shops to-day there are blueprints that the "old man" himself would not recognize as showing a part of his own inventions, if some one should cut the title corner off, and as for settling where the machining should begin, he would have to lose a good many minutes in study. Even the simpler drawings are a puzzle to the beginner and the foreman cannot be in all places at once. We should point out, on our drawings, by copious use of English and by means of routing sheets, just what the workman is expected to do.

I have not had the pleasure of visiting all of your shops, but the most of those that I have seen are open to this criticism. We are all drifting along, to some extent at least, in the old way of leaving a workman to his own initiative to find ways and means of doing a great share of the operations. The draftsman who learns to make drawings with the idea of saving time in the shop, gradually makes of himself an engineer in the true sense of the word, because in order to tell how a piece should be made, he first has to learn by consultation with those who do know. He is inducing himself to earn more money.

The foreman, who is fortunate enough to have his blueprints come to him in such form that the more intelligent of his men need little personal instruction and supervision, has more time to devote to the weaker members of his gang and his department output is higher—consequently, his own value increases.

Operator's Relation To His Work.

Right in line with this plan I recently tried an experiment that is interesting because it is illustrative of exactly what is going on in many shops and is causing the loss of a lot of money. A quantity of a certain small piece was sent to us by another firm to be ground. We had quoted on the work and there was a price we had to meet. As usual, in such cases, before letting the work start in the shop, we sent along with the pieces a routing sheet, which told how many pieces per hour we had estimated to be a fair production. The pieces were produced inside of the time limit and the net cost per piece was 1½ cents.

Several months later a lot of the same pieces came in and these were put into the shop and ground by the same man, but without anything to tell him what was expected of him. The second lot cost two cents each. Now the operator was not dishonest. I do not believe that he inten-

*From a paper read before the recent National Machine Tool Builders' Association Convention.

**Superintendent the Norton Grinding Co., Worcester, Mass.

tionally held back. He simply wasn't in business for himself. He would have produced these pieces for $1\frac{1}{2}$ cents if there had been any means supplied for concentrating his mind on the job. Even if he had run into an obstacle that he couldn't overcome, he would have called for help, quickly, in order to protect his own record. As it was the time drifted by without his having a very clear idea of anything in particular.

You've got to get the man interested, and there's only one way—put him into business for himself. How this is to be done, whether by premium or by piece-work, matters little, provided you see to it that more product means more wages. There is just this much about it—those of you who stick to a straight-day-work system, unless you devise ways of periodically rewarding increased efficiency, will lose your men to the shops that succeed in putting every man into business for himself.

Example of Cost Reduction.

I know of a shop that has reduced the cost of erecting its machines as shown by the following table, by doing two things: first, giving up the old, slipshod method of starting to erect before everything was ready, and second, by putting the assemblers into business by giving them a generous bonus for speed.

	Old Cost Average	New Cost Average
No. 1	$43.73	$22.62
No. 2	45.01	19.78
No. 3	45.21	18.26
No. 4	36.78	18.25
No. 5	41.26	18.84
No. 6	32.35	18.97

The bulk of this reduction was due to the fact that all of the parts were ready before the erecting was started, but a lot of the saving came from putting the men into business. Where they were formerly paid $3 per day, at day rates, they now earn about $4.50 per day, and the rest of you would have a difficult task in trying to hire one of these men to go back to the old $3 job, even if you guaranteed less exertion per 10 hours.

Incidents Arising From Up-to-date Practice.

An incident reported to me by the foreman of that job shows how it works out. He overheard one of the assemblers using rather forceful language to a truckman. It seems that the truckman had been sent to the stores to get a certain mechanism that was to be the next one to go on the machine. He arrived at the stores at about six o'clock, and, as the mechanism was covered with an anti-rust compound, the stores boy, not wishing to again wash his hands, put him off with some excuse. The truckman went back with an empty truck and the conversation overheard by the foreman was the result.

I cannot, for obvious reasons, quote verbatim what he told the truckman, but the gist of it was to get back to the stores with word that the mechanism had to be at the machine ready to be used at 7 o'clock the next day or something unpleasant would happen to both the truckman and the stores boy. That assembler was in business for himself.

Another incident: — A lot of gears were being machined at the turret lathe, and the operator could, ordinarily, make good pay at 10 cents each. The foundry had evidently made the gears of iron that was intended for larger work. They were hard. Under the old methods, it would be only by accident that this fact would be discovered before the job was completed. In this particular case the workman appealed to his forman who took the matter up with the superintendent. The result was that the foundry acknowledged its error, paid for the amount the operator ran behind and the expense was put where it belonged. That man was in business for himself.

POINTING OUT MANAGEMENT INEFFICIENCY.

A management that will accept, without considering it a personal affront, the statement that it is not as efficient as it could easily be made, and at the same time be so constituted mentally that it is eager to share with the producer in any saving that may be made, will easily find ways to reduce cost, and need have no fear either of being unable to get good men or to hold them loyal.

An operator noticed that some bars in a lot of tool steel machined much more rapidly than others. His insistence on having all the bars good ones led to a thorough investigation of the whole question, and the formulation of specifications on tool steel, that now enable that firm to form 3-in. diameter tool steel bars with tools 3 in. wide at a surface speed of over 100 ft. per minute.

Rate-Setting Department Essential.

The firm, from whose experience these incidents have been cited, believes that the best way to put a man into business so that he can share profits on each job he does is to have a rate-setting department made up of good operators, under the leadership of a man who is, himself, capable of taking hold of any productive job in the works. It is almost always found to be a fact that a careful study of a job, not by the stop watch, but by actually doing it, leads to improvement. Sometimes there is only a slight gain. In other cases the time has been reduced to one-third of its former time.

The rates are set on the principle that since it has been found possible to reduce the cost and the concern was satisfied with that cost before this discovery, then the new rate can be placed well above what it actually can be done for. This is contrary to the old spirit of management, but is right in line with what most machine tool men at least believe, and is the only way you can get your men into business for themselves.

In this connection I do not wish to be understood when I mention the stop watch, as not agreeing that oftentimes facts can be learned and gains made through the medium of so-called efficiency workers, who are themselves perhaps incapable of performing the operations, but who are intelligent observers. What I do mean is that, personally, I believe the greater savings are to be made by having a skilled man study the job from an inventor's standpoint rather than from that of a recorder or historian. All interferences with production are not evident to a mere observer. Most of them hark back to the design or to conditions imposed by the relations of a given piece to others in the same machine.

Commonsense Scheme a Sure Winner.

The efficiency movement, like many other great movements, has its quacks who seize the time of unrest to play upon the credulous ignorant, but every one of us should be thankful for the impetus given to our minds by the crusade definitely started by F. W. Taylor. The obtaining of the benefits of this common sense scheme need not cost anything. In fact it can be made to pay almost from the beginning. One good man can do enough for a group of men in so short a time that the extra production of the group will pay not only for the money spent on them, but also for further work with other groups. The scheme, properly conducted on a common sense basis, without frills, is soon compounding its gains. Such a movement, to be successful, requires the hearty backing of the management, for there will always be men in every organization, perfectly honest in their views, but who are unable to see beyond the tips of their own noses, when it comes to making a change from the established order of things.

A management that will accept, without considering it a personal affront, the statement that it is not as efficient as it could easily be made, and at the same time be so constituted mentally that it is eager to share with the pro-

ducer in any saving that may be made, will easily find ways to reduce cost and need have no fear of either being unable to get good men or to hold them loyal.

Educating the Operative as to Values.

Men are more often careless through ignorance than by nature or intent. The man who spoils a piece of work knows that he has destroyed value, but to him the time lost is usually the item that appears to be the most important. Men should be educated in the total value of the goods they handle. They should know the cost of materials and approximately the shop burden.

I know one superintendent who has adopted the system of having all spoiled work reported to him on a card that states the fault and the number of pieces spoiled. Whenever the case is of enough importance to attract his attention he makes it the excuse for a friendly talk with the man who did the job. He talks the affair over in a way that brings out both sides of the case. Before he lets go of that incident he has taught that man a whole lot about what it costs to carry the burden of a business. He has done more good than any "call down" would do, and he has strengthened the workman's loyalty to the firm, and this, without saying, includes a determination to spoil no more if he can help it.

Discharge should be the last resort, and a frequent use, under ordinary conditions, of the power of discharge, for any reason other than the lack of work is the sign of a poor shop management. Under the management that finds its main corrective in discharge, the new man will be at a still further disadvantage because he will not have had the experience that caused the downfall of his predecessor.

Making the Foreman an Executive.

Now and then you will find a foreman who is a natural born business man, but this kind is rare, as foremen are usually promoted to their positions because they are good workmen, and not because of the other qualities that a foreman should have. There is a lot of difference between a good workman and being a good executive. Most foremen have no definite idea of the cost of anything, except net labor, and it is not their fault either. Management rarely interests itself in a foreman to the extent of trying to make a real business man out of him. Yet the returns are well worth the effort.

Just start a scheme whereby each foreman really runs his own department and knows exactly where every cent is spent for which he is responsible, and you will find a most interested and watchful lot of men. You will find that having the entire list of officers on the alert for economy is away ahead of trying to do all of the worrying yourself about the time the cost department reports the facts, which is several weeks after the damage is done.

At the Norton Grinding Company we keep an account against each foreman and gang boss of all of the expenses for which he is directly responsible, that is, repairs and replacements, supplies, non-productive labor, spoiled work, etc. Such items as taxes, rent, power, etc., are, of course, not considered, as he has no direct control over them. The total of his expenses divided by the total of his productive labor gives what we, for the sake of comparison, call the overhead of his department. At the end of the month he is given by the cost department all of his supply requisitions with the costs marked in, and all through the month, if another foreman does for him any non-productive job, such as repairing a machine or grinding a cutter, a duplicate of the time card is sent to him with the total money cost showing. This system has aroused more interest among the foremen than any scheme we have yet found.

> **MANAGEMENT INTEREST IN FOREMEN.**
>
> **Management rarely interests itself in foremen to the extent of trying to make them real business men, yet the returns are well worth the effort. Just start a scheme whereby each foreman really runs his own department and knows exactly where every cent is spent for which he is responsible, and you will find a most interested and watchful lot of men.**

Interest Among Foremen.

One foreman found that he was being charged $10 per week for trucking, the truckman, up to that time, being responsible to the head inspector, and responding to calls much the same as the bell boy plan in a hotel. The foreman kept careful record for a few weeks, and then made the announcement to me that his trucking was worth only $6 per week and that he didn't want to pay $10 for it. The result was that we took one truckman away from the inspector and put him at productive work in the casting department, and the foreman hired a cheaper man to do simple productive work some of the time and trucking when it was needed.

Another foreman came to me with a milling cutter and said: "We make cutter grinders for sale. How much time would you tell a customer that it would take to grind this?" I knew something was up, so I was conservative. My estimate was that it ought not to take over two hours. He thereupon produced a charge by another foreman of sixteen hours for the job. We both made a trip to see the other foreman, with the result that the charge was reduced to two hours, which all agreed was ample. The foreman who had done the job was charged with fourteen hours of spoiled work, and the grinder operator was given his notice because his foreman said this was simply the climax of several such incidents, and he had failed to show any interest.

Even second-hand belting suddenly assumed great importance. I did not, at first, foresee that hairs would be split so fine, but it did not take long before a foreman wanted to know what became of a certain belt that was taken out of his department and replaced by a new one. I told him the good part of it would be spliced to another piece and used again. He wanted to know if I didn't think he ought to have credit. So now, when we take an old belt out, if the man in charge of belting says the bulk of it can be used again after cleaning and repairing, we credit the department with one-half the price of a new belt. When we use that belt again we charge the department getting it with one-half the price of a new belt.

Cotton waste is down to ¼ lb. per week per man using waste, and belting is down to $18 per month, average, for the whole shop, where there are 1,160 belts in almost constant use every working day.

The foremen are enthusiastic over the scheme. One foreman said, "Sure, I like it. It teaches me so much about my job that if you don't treat me right, I can go to some one else and tell him for just how much I can run a department, including my own wages." That is just the position we want him to be in, because we, being on the inside, know all about him and ought to be able to keep him, if we consider him worth keeping. If, by poor judgment on our part, he leaves and is really worth more, then we can rejoice with him that he has benefited.

Relative to the Superintendent.

The superintendent should never be too busy to take care of any matter that the foremen or workmen think is important, whether or not it is firm's business or personal, and he should be a man in whose word the men have confidence. His training and his actions should be such that the men will know that he is not asking for anything unreasonable, or that he would not do himself. He must be an enthusiast in his business. He must be a boy with the

boys; in fact, he must never forget to be a boy at heart. All first-class enthusiasts are. He must always be on the lookout for good qualities in men. He must campaign for loyalty, a shop's best asset, just as the nation, through the public schools, campaigns for patriotism, for both are the result of plan and not of accident. Loyalty, like patriotism, is spontaneous only in times of intense emotion. It has to be created and fostered by well-laid plans that have for their fundamental principle, the giving of value for value received.

The superintendent must have the co-operation of the management in teaching the so-called non-producer that the business of capital is to make dividends, and that the only exense for his particular non-productive existence is to help productive labor to make more chips or to get something assembled faster or better, and that the closing of his day's duties at a certain hour is merely an unimportant incident instead of being the great event that tradition has made it.

THE FACTOR OF SAFETY.

IN a paper read recently before the Staffordshire Iron and Steel Institute, Mr. C. E. Stromeyer, chief engineer of the Manchester Steam Users' Association, said that the expression **Factor of Safety** was adopted by the engineers of the early days of the last century, when structures in iron were novelties, in order to inspire confidence in those who were going to use them. It may also have been hoped that a competition amongst engineers for high **factors of safety** would conduce to safety; at any rate, Sir William Fairbairn at one time seems to have advocated a **factor of safety** of seven. The public, however, refused to be made judges in technical matters, and preferred to rely on the expert knowledge of engineers, amongst whom the expression **Factor of Safety** then merely meant **Measure of our Ignorance.**

In those early days our ignorance was truly great, for materials could not be tested, and the mathematical treatment of many engineering subjects was still in its infancy, but now, although much progress has been made in both directions, many engineers still cling to the expression **factor of safety**, though, on the Continent, the somewhat more expressive term **permissible working pressure** is now commonly used. The one term glosses over the fact that we do not, for instance, know definitely what is the ratio between safe working stress and ultimate tenacity, and the other term merely states that engineers refuse to be guided by laboratory tests, and have by experience fixed on certain stresses as being safe.

Both expressions hide the fact that the mathematical formulae used by engineers are of the crudest, and do not correctly determine the actual stresses produced by external forces, they also hide the fact that these external forces are sometimes very imperfectly known, and they hide the fact that even when using the most carefully-tested materials, and handling them with the greatest care in the workshops, there is always a chance of a flaw or a brittle locality, which may cause failure.

Case of a Rivet in Shear.

Consider the case of a rivet, said Mr. Stromeyer, which is subjected to a steadily-increasing shearing stress. The intensity of this stress will be distributed over its section in the form of a paraboloid of rotation, and the maximum stress at the centre of the section is then seen to be double the mean stress.

Suppose the limit of elasticity for shear to be 8 tons per square inch, then this limit will be reached when the mean stress exceeds 4 tons per square inch. This maximum stress of 8 tons should not be exceeded under safe working conditions, but engineers only refer to the average stress, and compare this with the ultimate shearing stress in the rivet of, say, 20 tons, which, before rupture, is, of course, uniformly distributed over the section, and they fondly imagine that, as the ratio between the average elastic stress of 4 tons, and the ultimate plastic stress of 20 tons is as 1 to 5, they are working with a **factor of safety** of 5, whereas, in reality, this factor is made up of 50 per cent. of mathematical convenience, and 50 per cent. of ignorance as to the true value of the elastic limit, which, judging by recent fatigue experiments, is much lower than was at one time imagined.

Straining a Beam to Its Elastic Limit.

When straining a beam up to its elastic limit, of, say, 10 tons per square inch, the maximum elastic stress is expressed by the formula $S = 6\ M1 : b\ h^2$, whereas, when this limit is passed and the ultimate stress of, say, 30 tons is approached, this stress is expressed by the formula $S = 4\ M2 : b\ h^2$, and the ratio of the ultimate to the elastic moment is $M2 : M1 = 30 \times 6 : 10 \times 4 = 4.5$, which, by most engineers, is looked upon as being the **factor of safety**, whereas the real factor is $30 : 10 = 3$. Thus, in the one case the ratio between ultimate strength and limit of elasticity is doubled in order to arrive at the **factor of safety**, and in the other case it is only increased 50 per cent.

These two examples, and many more could be adduced to justify the continental practice of using the term **permissible stresses** when associated with particular engineering formulae.

External Force Feature.

Similar remarks apply to what might be called external forces, about which the mathematics as used by engineers are often far from comprehensive. Most engineering text-books demonstrate that a load which is applied suddenly results in a stress which is twice as great as that which a gradually-increasing load will produce, and engineers seem to rely on this one demonstration for their practice of assuming that stresses due to live loads are twice as great as those due to steady loads.

This is merely a mathematical convenience for average conditions, for it ignores the fact that the expression is only true if the load be a weight. The suddenness of the steam admission into a cylinder, and the suddenness of a gas explosion, do not double the stresses in the cylinders, pistons and rods beyond what they would be under a steady pressure of the same intensity, and, on the other hand, the sudden application of pressure which occurs when two elastic bodies collide leads to much severer stresses than double the static one.

If each case were dealt with on its merits the estimated stresses would often be much intenser than the customary rules make them out to be, and the **factor of safety** would be found to be much lower than was believed. Then, however, the very legitimate conclusion could be drawn that if certain structures are safe with these comparatively low factors, other structures for which improved mathematics show large factors might be reduced in dimensions.

The term **factor of safety** also covers our ignorance of the real properties of materials and their behaviors when stressed. Much has been done in the past by the introduction of quality tests and the use of testing machines, but much yet remains to be done before even engineers can take the initial step of defining how many chances there are for and against occasional failures.

OFFICE TIME STUDIES.

COST of letters and orders is receiving attention by firms who realize that ascertaining the cost of writing an order is as important as knowing the price of a manufactured part.

One concern who recently took up this question ascertained that, in January, 27 minutes were consumed in handling every order, and in February 29 minutes: net average of 28 minutes, at a cost of 14 cents for clerical hire, independent of all other expenses.

Neither of these facts are difficult to ascertain, and no firm can hope to have orders handled efficiently until they have a basis to work upon.

Value of a Hobby and its Pursuit by Otherwise Busy Men

By George Sherwood Hodgins*

Whether or not a hobby be useful work for the world, its value lies very largely, if not wholly in the fact that it affords an opportunity for a complete change, not only in the character of the work done, but in the bodily surroundings and change of scene, or change of air.

DID you ever stop to think that we do a lot of things for which our bodies are not particularly well adapted? We use our eyes on printed pages, which is certainly not what the ancestral eye was evolved for. We live in steam-heated houses and work in steam-heated offices. We very seldom get a real sun bath. We continue at the same kind of work day after day with very little out-door exercise. We eat too fast and too much, and often take the wrong kind of food. We maintain an habitually upright position of the body, which is certainly not the practice of the man-like apes, who are our nearest relatives in the flesh. We do all these things and many more of the same kind, with apparent facility and without much thought, and still we live and work.

How far this mode of life is removed from Nature becomes apparent, only when we, with mistaken kindness, take some more "natural" race, such as the North American Indians and subject them to like treatment. The "civilization" of the savage usually results in his discomfort, disease and death, and in time his race becomes extinct. We live as we do, by virtue of an abnormal heredity which has very probably become ours as the result of a far-reaching experiment as to the best way to fit the race for its self-made economic and industrial system, and its other forms of "artificial" existence. We are still making the experiment and the end of it all is not yet in sight.

In speaking of the Anthropoids, or man-like apes as our nearest relatives, we do not mean to assert the correctness of the popular idea that man is descended from a monkey, but rather that both are derived from a common stock, like separate branches on the same tree. The fundamental unity of man and the man-like apes lies in design, structure, and physical characteristics, and this is evidenced from their both having developed upward, along divergent lines, from the same original stock.

If then, it is conceded that man to-day is engaged in pursuits for which nature did not intend him or specially fit him, and that he is really in the transition period, emerging from the thraldom of fear and the tyranny of the physically strong, and striving for the care-free life to which he has not yet attained, then it follows that he has been forced to adopt many devices and artifices or enlarge those he has had, in order to produce effects, which once were his possessions in the vigorous, free, outdoor life of his remote ancestors. He has even yet, in his sedentary life to maintain some slender connection with nature and the past.

The unnatural use of the eye produces disturbances which have to be corrected by the use of spectacles. Often the hearing has to be supplemented by the use of the aucousticau. Gymnastic exercises and athletic games take the place of the struggles of war and the exertions of the chase, and careful dieting has to be observed, when the body is out of order, so that it may be fitted for the particular kind of work which has to be done by the individual, under our subdivided economic and industrial conditions.

GETTING BACK TO NATURE.

We are the result of evolution, and even fortified by the effects of our somewhat artificial training and our abnormal heredity, we must still, in some form, "get back to nature," and the beneficial effects of the pursuit of a hobby as a means of approximately attaining that end has raised it above the level of a mere pastime to that of a serious and scientific necessity.

The brain is used more extensively now than in the primal stage of man's existence, and as a consequence a more highly developed brain and nervous system is the result. The progress we have made in this direction stands out very distinctly when we contrast ourselves with savages of equal or even superior physical development. The clean, quickly-made incision of a polished Mauser bullet in the non-vital part of the anatomy of a modern soldier is capable of so disturbing his whole nervous system as to place him temporarily hors-de-combat. he cannot go on. The less "civilized" man is, for the time, unaffected by the bullet wound. The less finely his nervous system is, the less he suffers from shock, and thus the savage may fight his way right into the enemy's lines, and there fiercely strike his blows, even after he has received a mortal wound. It requires the jagged, shattering death-blow of the dum-dum bullet to at once check his valorous and headlong rush.

The modern business man, or factory head, or thinker in whatever walk of life he be is equipped with a brain and nervous system, finely organized and highly complex, responding quickly to shock or stimulus, doing without many of the once vital connections with nature. This brain is made to work with tread-mill regularity, that its owner may accumulate money, or place or power. In thus getting, at least partially, away from "mother earth," and all that this implies and relying on the product of the brain as the one and only necessary output required to sustain existence, man has practically sailed out on an unchartered sea. The brain is his chief "tool," and with it he fashions life, most often without knowing the nature or the possibilities of what he uses. He has brought himself within the influence of psychological environment, the gradual mastery of which he is bound at last to attain.

Influence of a Man's Surroundings.

A good many men think themselves unaffected by their surroundings, and though their homes are comfortably or even artistically furnished, their offices are generally bare and unattractive, and are without many minor conveniences. The consensus of scientific opinion to-day is that man is most decidedly affected by his surroundings. Instances are not wanting in which the presence of a few flowers has added to the pleasure or the contentment of the workers in a factory, and this feeling is not without its commercial value. Munsterberg tells us of the introduction of a cat into a workroom where men were engaged in fatiguing work. The presence of the cat stimulated their social consciousness and became a joy-giving plaything for the men. The presence of the animal did not interfere with the amount of work done, but rather improved it by forming a pleasant diversion for the minds of the toilers. Many experiments made in psycological laboratories have shown what hours of the day and what season of the year are productive of maximum output. The head of a large factory in Germany found that the shortening of the

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working day from nine to eight hours resulted in increased production. His experiment and his deductions therefrom, have been corroborated wherever a similar change has been made.

It is frequently found that workers of all kinds say, and indeed believe, that what goes on around them does not affect their power to work. Carefully conducted experiments, however, prove that noise, bustle, and apparent confusion, have distracting effects on the attention, even though the worker himself may not be conscious of them. In a printing establishment, a woman, presumably a proof-reader, was seated near an aisle in a busy and noisy work-room. When she was removed to a quiet corner it was found that her work had increased 25 per cent. It seems fair to suppose that the distractions which break the continuity of attention even in small ways which do not rouse pleasant feelings must be constantly counteracted by a nervous expenditure, which may not be noticeable to the worker, but which like the internal friction of a machine, burns up fuel and is, from an economic point of view, simply waste.

Again to return to the modern business man, factory head or professional worker, and applying to his case the same reasoning that fits the case of those whose work contains more drudgery, we find that he, like them, is affected by his surroundings. He is amenable to distractions and that he often has to force his mind to work while he carries other handicaps which his responsible position forces on him.

Nature's Aid—Semi-Reflex Action.

In all this, nature has lent us a helping hand. It is the tendency of all constantly repeated actions to become partly automatic. Men of science call this class of action "semi-reflex." The following is an example of pure reflex action. As an example take that which results from the entrance of a cinder or piece of dust into the eye. The lids close tightly and a copious flow of tears tends to wash it out. The act is involuntary and like other pure reflex actions usually is of service to the individual. Habitual performance perhaps prolonged or lengthened into a series involving several distinct actions, runs along without affecting the mind. The sensation produced by a completed muscular action is sufficient to start the next and so on through the series, the intellect taking note only of the final result. The mind is thus set free to a very great extent, and in this way a natural economy is brought about so that the mind may go on practically uninterrupted with its own more important work.

An example of semi-reflex action, in which the mind acted incompletely by over attention to its own immediate business, lately came to the knowledge of the writer. A lady who was a most diligent and excellent housekeeper was in the habit of making a daily round of the cellar in order to bring up with her the things she needed for the day. It was her custom in the dark mornings of the winter to turn an electric switch as she went down the cellar stairs. The turning of the switch lighted several electric bulbs, so that her inspection of the larder was made in a full flood of light. On coming up the cellar stairs, she invariably turned the switch and extinguished the bulbs. As the mornings got brighter with the advance of the season, and daylight streamed in through the cellar windows, the lighting of the bulbs was consciously omitted at first, but later became semi-automatic. On coming up the cellar stairs, and in conformity to habit, the electric switch was turned so that the bulbs were made to glow. This went on for several days before it was discovered. In the last case we have a sort of semi-reflex action in which the lighting of the bulbs was purposely omitted, but the flood of daylight was not consciously noticed by the mind closely occupied by household matters, and the last act of the series was automatically performed, without conscious knowledge that the whole lighting process had now been reversed, and that electric lamps were left alight when the lady was not in the cellar. Her known carefulness about details shows that the act had not been noticed owing to its semi-reflex character.

INFLUENCE OF OUR SURROUNDINGS.

A good many men think themselves unaffected by their surroundings, and though their homes are comfortably or even artistically furnished, their offices are generally bare and unattractive, and are without many minor conveniences. The consensus of scientific opinion to-day is that man is most decidedly affected by his surroundings. Instances are not wanting in which the presence of a few flowers has added to the pleasure or the contentment of the workers in a factory, and this feeling is not without its commercial value.

This occurrence perhaps gives a hint of how some kinds of mistakes, made by otherwise thoughtful persons, may occasionally take place. At any rate it shows Nature's effort to liberate the mind from the abstractions, which while inevitable, do not form an essential part of the business to be done. Acts which do not reach the threshold of conscious perception are in the nature of an intellectual economy which nature has provided, that we may do the work we set out to do.

This intellectual economy, if one may say so, seems to be more like a sort of temporary postponement of fatigue, and not a removal of its cumulative effects. There are constantly showered on the organs of sense, innumerable impressions which are each one "handled" with great promptness. Each one is forwarded to the brain whether or not it is pertinent to the matter in hand. The mind cannot deal with or act on all these, though as Prof. William James tells us, "All mental states (no matter what their character as regards utility may be), are followed by bodily activity of some sort. They lead to inconspicuous breathing, circulation, general muscular attention and glandular or other visceral activity even if they do not lead to conspicuous movements of the muscles in daily life." It is clear that constant yet unobserved bodily action is really taking place, and it is probable that this effect together with prolonged effort of will required to hold the attention on the work before us is what makes us grow tired and ultimately fagged out. This is in addition to the fatigue of the brain itself, viewed as an organ.

Brain Fag.

In view of a great deal of available evidence it does not seem as if the brain alone become so tired as to halt at its work. There are so many other circumstances of an undesirable nature surrounding protracted work that the cumulative result of their effects would seem to be in great measure the real cause of a break down. A sort of rough analogy is presented by what is known on a railway as an "engine failure." This is practically that if a train be stopped anywhere, at a station or on the road and cannot move forward again after four minutes when the operating department is ready, the detention is booked as an engine failure. In any list of such failures, the derangement of the headlight would likely cause an insignificant proportion of the total, while "leaky flues" would probably amount to a considerable number, especially in bad weather. Pure brain fag is not likely often to occur amid pleasant and advantageous surroundings as it is when accompanied with resisted and detrimental stimuli.

Brain action, especially when continuous, makes a heavy demand upon the blood supply and the surroundings of a man engaged in brain work are too often

such that he is unknowingly endeavoring to make the best of adverse conditions, in which want of exercise, noise, bad ventilation, dusty germ-laden air, bad light, confusion, interruptions, undesirable personalities, distractions, set hours, disappointments and the failure of others to meet expectations, all add their quota of discomfort. All this becomes accentuated if the man be engaged in the technical and laborious monotony of high grade work, such as checking the strain sheet of a cantilever bridge.

It is not unusual to hear a man thus conditioned sigh for rest or at least for quiet where he can work in peace. Work itself is not distasteful to the average man, and he is indeed to be pitied who would desire to do nothing. Munsterberg has pointed out that even monotony in work is not necessarily more fatiguing than variety. In fact, habit, as Prof. James says, is the great flywheel of society. It prevents the hardest and most repulsive walks of life from being deserted. It even keeps different social strata from mixing, and it makes each individual fight out the battle of life upon lines he is accustomed to, rather than risk a change or seek the temporarily unknown.

The Hobby Feature.

What, say you, has all this to do with the value of a hobby? Simply that whether or not a hobby is useful work for the world, its value lies very largely, if not wholly in the fact that it affords an opportunity for a complete change, not only in the character of the work done, but in the bodily surroundings, and "change of scene," or "change of air." Dean Swift worked and strove to obtain the mitre. His real ambition lay in the direction of ecclesiastical advancement. He wrote simply as a pastime, but the world knows him only as a man of letters and a wit.

Hobbies of Prominent Men.

Even when the "work" entailed by a hobby is what most men call play there is the absence of "strain." Arthur Balfour, formerly Premier of Great Britain, was recently called from a tennis match at Cannes to speak in the House of Commons on Irish Home Rule. Balfour is an enthusiastic golf player; yet no one will say that the surpassing of "bogey" has any "survival value" for the world at large. It is also certain that less accomplished players approach the links with feelings of pleasant anticipation.

The "work" has in it all the theoretical elements of monotony, yet no such condition is usually experienced. There is pure air, sunlight, exercise, quiet, congenial companions, absence of hurry and distraction, with all that goes to make what we call enjoyment. These things when analyzed produce healthy activity of the body, and if it were possible to work in the office amid the same surroundings as those of the tennis court or the golf links, it is more than probable that business would have much the same effect, apart from actual brain fatigue, for the pursuit of some game, regularly played, placed it in the class of hobbies.

Lord Avebury (Sir John Lubbock), was a banker in "school hours," but he made a hobby of the painstaking study of ants, bees, and wasps, and has not only written extensively on the subject, but has brought to light many interesting and scientific facts. It is needless to say that his off-time work has been carried on so as to produce, even while accompanied by the closest attention, and a high degree of concentration, the very opposite results from that occasioned by unremitting attention to business, amid the harassing distractions and interruptions of the office.

> **HABIT.**
>
> **Habit is the great flywheel of society. It prevents the hardest and most repulsive walks of life from being deserted. It even keeps different social strata from mixing, and it makes each individual fight out the battle of life upon lines he is accustomed to, rather than risk a change or seek the temporarily unknown.**

The late Lord Salisbury was an amateur chemist, when the affairs of state did not engross his attention, and he, like Lord Avebury, was compelled to pursue his labors with the same patience as that required by many an office drudge.

John Tyndall, the famous physicist, was during his lifetime, an enthusiastic alpine climber, and made many valuable observations on the movements of glaciers, and the flora to be found at high altitudes. His work was, of course scientific in scope, while it did for him what the more or less unproductive relaxations do for other men.

Writing was Elbert Hubbard's hobby until he found it to be a live horse, and rode away on it. He has now two magazines, The Philistine and The Fra, in which he and his contributors say their say without fear or favor.

Henry Ford, he of the "Ford Car," has made a hobby of bird life, and has probably done, and is doing more to protect birds and to encourage those who bring desirable species to the United States, than any other single agency. These hobbies are in no sense, fads. They have a double use. They promote the health and happiness and therefore the well-being of the man who has them, but they do good to others.

Andrew Carnegie, to whom in early life books were a priceless treasure, has made a hobby of libraries. He seeks to freely give what was once so difficult for him to obtain.

The famous John D. Rockefeller has taken up forestry and good roads as a twin hobby.

The activity of these two men proves that the mind needs exercise, as well as do the limbs. Neither of these men is compelled by any ordinary consideration to work as the majority of people work. There is in all states an imperative necessity, inherent in the mind itself which demands some form of employment, and the so-called "idle rich" can no more escape from the operation of this universal law, than he can, who toils for a daily wage.

William T. Noonan, president of the Buffalo, Rochester & Pittsburg Railway, is a lover of horses, and has many an early ride before business hours. Perhaps one might say he has made a hobby of health.

Frederick D. Underwood, president of the Erie Railroad, is a collector of watches.

Caruso is a caricaturist of some artistic skill.

Theodore Roosevelt is a faunal naturalist.

It is not necessary to suppose that these men's offices are unpleasant or dark, or filled with disturbing noises. There is no doubt that they, like all conscientious workers, are subject to the same distractions in their business hours, that come unbidden from without, and invade the working mind. These distractions set up "states of consciousness," and produce the unnoticed bodily activity, and the constant automatic repression of them, so that brain work may be unhindered, uses up nervous force.

King George V., is a stamp collector in his private life.

Joseph Chamberlain, the lately retired British statesman, is an orchid grower.

Paderewski raises chickens, while Frederick Phinney's hobby is the collection of gems.

John Paterson, of the New York Central, has made health his hobby, and William C. Brown, formerly president of the same road, is a farmer in his spare time.

James J. Hill collects pictures, while the late J. Pierpont Morgan was a most successful and discriminating collector of rare books, pictures, and objects of art.

A. M. Todd, of Kalamazoo, Mich, is

a book collector, and now has many thousand volumes.

John D. Archibald steers his private yacht daily to and from business in order to obtain that variety which is the very spice of life.

The wear and tear of office life is undeniable, and the many distractions, to which we have referred above, and the multitudinous sense impressions which constantly invade the mind of the brain worker, are to a great extent automatically repressed by nature, as one of her economies. Nerve force must, however, be expended in the constant repression of sensations so that they may not reach the threshold of consciousness. This constant output of power may not at any moment be noticeable, but it is there, and its effects are among the things that persist.

Primitive man was not hampered in the same way as we are, for like a child he gave way to every gust of feeling and was ever in a state of change. Nature repressed much for him, and in the same way as it does for us, but he was free from the effort of continuous and steady application to a single line of abstract thought. We are the result of evolution, and even fortified by the effects of our somewhat artificial training and our abnormal heredity, we must still, in some form, "get back to nature," and the beneficial effects of the pursuit of a hobby as a means of approximately attaining that end, has raised it above the level of a mere pastime to that of a serious and scientific necessity.

COMPARATIVE ECONOMICS OF TRAMWAYS AND RAILLESS ELECTRIC TRACTION.

By T. G. Gribble, M.Inst.C.E.

THE RAILLESS electric traction system, otherwise designated the "trolley-bus," or "trackless trolley," already forms in several cities an extension to the tramways system, and the applications to Parliament for the authorization of similar lines are numerous. The purpose of the paper read before the Institute of Civil Engineers is to discuss the various economic features of the system, as compared with those of tramways, with a view to the definition of the sphere of usefulness which is open to the former.

The initiation of the system, in contrast with the general history of new forms of transportation, is due, not to Government aid or private enterprise, but to municipal tramway committees, and it is pointed out that the Light Railways Act has failed to effect what was intended by it, and in contrast, attention is drawn to the immense and profitable development of light railways in Belgium.

The necessity for the further utilization of the highways is urged, because of the centralization and congestion of population which has resulted from the development of the railway system. The distinctive economic features of tramways and railless electric traction are defined, and an analysis is made of the statistics of British municipal tramways, both as to cost of construction and working expenses.

Railless electric traction is compared with the tramway as to carrying power, capital expenditure and working costs, by means of generalizations deduced from the above statistics. These generalizations are in the form of curves and tables, while the working expenses are analyzed in a table. Attention is drawn to the great variation in the cases cited of the cost of energy, greater than can be accounted for by the price of fuel. Cases are added of foreign tramways which operate with trailer cars.

An illustrated description is given of tests made by the author of current consumption on an electric omnibus propelled by means of accumulators on London streets, also of tests made on a railless electric car at Bradford. The general conclusion drawn is that it requires no more current to carry the passenger by railless electric traction than it does by a tramway. The maintenance of rubber tires is touched upon in regard to the principal causes of wear and tear, and of the effect of tropical climates.

The subject of the responsibility for the upkeep of public roads is dwelt upon at some length, in view of the altered conditions resulting from the introduction of mechanically propelled vehicles, and the present necessity of special Acts of Parliament for the authorization of railless electric lines is represented as a hardship which calls for relief at the hands of the Legislature.

The comparative economies of tramways and railless electric traction are finally embodied in three diagrams, arranged to show the respective capital expenditure and working expenses under analogous conditions for services of different traffic density, ranging from a service of 30 minutes' interval to one of 2½ minutes.

Conclusions.

The general conclusions are:—

(1) That with a traffic density represented by a 2½-minute service—that is to say, that of one of the largest tramways—the economy of construction and operation is still in favor of railless electric traction; as to the cost of operation by about 7 per cent., and as to cost of construction by about 44 per cent.

(2) That the economy increases inversely with the traffic density; so that with a time interval of 30 minutes the economy of operation is about 36 per cent., and that of cost of construction about 70 per cent.

Reference is made to the York tramways, the most recent case of a municipal tramway, in support of the argument that an even more important point than that of saving of expenditure is the possibility, by means of economic transportation, of serving the suburbs and the rural population. It is argued that the tramway at York, 6 miles in length, excellent though it is, does not serve all the suburbs, and that, by means of railless electric traction, for the same capital expenditure, 16 miles might have been constructed and operated; thus completely reaching the extreme suburbs, and incidentally raising the value of property in the vicinity of the city.

A tribute is paid to the enterprise and initiative ability of the leaders of municipal tramways in having taken up the burden of experiment and proof of the system which seems to them the normal form of extension of their tramways.

COMING CONVENTIONS.

Master Boiler Makers' Associatinn. — Philadelphia, May 25-28. H. D. Vought, secretary, 95 Liberty Street, New York.

Master Car Builders.—Atlantic City, June 10. Joseph W. Taylor, secretary, Karpen building, Chicago.

Railway Electrical Engineers.—Atlantic City, June 10. J. A. Audreucetti, secretary-treasurer, C. & N. W. Ry., Chicago.

Railway Supply Manufacturers' Association.—Atlantic City, June 10-17. J. D. Conway, secretary, 630 Oliver building, Pittsburgh.

American Society of Mechanical Engineers.—June 16-19, Minneapolis (headquarters at University of Minnesota). Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York.

American Institute of Chemical Engineers.—Troy, N.Y., June 17-20. J. C. Olsen, secretary, Brooklyn Polytechnic Institute, Brooklyn, N.Y.

Railway Master Mechanics.—Atlantic City, June 15-17. Joseph W. Taylor, secretary, Karpen building, Chicago.

American Society for Testing Materials.—Atlantic City, June 30-July 4 (headquarters Hotel Traymore). Prof. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Pa.

Railway Tool Foremen's Association. — Chicago July 20-22. A. R. Davis, secretary-treasurer, 730 Pine street, Macon, Ga.

Railroad Master Blacksmiths. — Milwaukee, August 18-20. A. L. Woodward, secretary, C., H. & D. Railway, Lima, O.

American Foundrymen's Association. — Chicago, September 7-10 (headquarters Hotel LaSalle). A. O. Backert, secretary, Penton building, Cleveland.

Railway Bridge and Building Associatinn. — Los Angeles, October 20-22. C. A. Lichty, secretary, C. & N. W. Railway, Chicago.

Bridge and Building Supply Men's Association. —Los Angeles, October 20-22. H. A. Nealy, secretary, Joseph Dixon Crucible Company, Boston.

Railway Electrical Manufacturers' Supply Association. — Chicago, October. J. Scribner, 1010 Monadnock building, Chicago.

With vanadium steel dies punching 90,000 punchings are said to be secured in making gaskets from unpickeled sheet steel. The best production formerly obtained with ordinary tool steel dies without regrinding was 40,000 punchings.

SYSTEMATIC BUSINESS MANAGEMENT

Practical Articles for Managers, Superintendents, and Foremen, to Assist in Carrying on the Business Economically and Efficiently.

EFFICIENCY ENGINEERING.

AN unusually interesting and practical address on "Efficiency Engineering Applied to Mines, Quarries and Industrial Plants" was delivered recently before the Canadian Mining Institute at Montreal, by Mr. H. M. Payne, of New York. It was racy, but it was highly sensible. Mr. Payne impressed on his hearers that gaining, in a commonsense way, the co-operation of employees was a prime requisite of efficiency engineering.

"I wish," he said, "that there were in the English language such a phrase as efficiency engineering. I am ready to grant that this method of scientific management can be applied, with the refinements of cruelty, to stop-watches, but the efficiency engineering I propose is to eliminate all red tape, and to humanize the engineer's work. A man's time and skill can be bought, but his co-operation cannot be bought. My idea of efficiency engineering is not a colorless standardization, but rather an emphasized individuality."

CONDUCT RULES BY JAPANESE NOTABLE.

THE late General Nogi, who enjoys the unreserved admiration of the Japanese, on the night of the funeral of the late Emperor, issued a note of disciplinary instructions for the pupils of the grammar grade of the Peers' School. The note contains fourteen instructions, and truly reflects the spirit with which the late general led the pupils of the school. The gist of the instructions is as follows:

Keep your mouth closed. He who has always his mouth open shows that his mind is blank.

Mind what you are looking at. One whose eye is always wandering tells that his mind is also wandering.

When paying your respects, look at the person whom your are saluting.

Do not forget your coat-of-arms, family standing, and ancestors. Due respect to your ancestors is important.

A boy should act like a boy. Avoid becoming effeminate.

Never indulge in luxury. There is nothing that makes a fool of a man like luxury.

Ride in rikishas as little as possible. Even if a riskisha is sent for you, try to walk home.

How many of you wash your face with cold water in the winter? You should not use warm water.

When it is cold think it is hot; and when it is hot think it is cold.

It is a shame to wear torn clothes without mending them, but to wear the torn part patched is nothing to be ashamed of.

Know what is shame; he who does not know what is shame is inferior to dumb animals.

While in good health, train yourself so as to endure physical labor. When you are ill, however, obey your physician's instructions.

Make your clothes and shoes bigger. Never mind the style or shape.

Become a man useful to your country. Whoever cannot be so is better dead.

BRINGING EMPLOYEES UNDER OBSERVATION.

THAT scheme of the Canadian Pacific Railway Co. to discover the good and bad points of its employees, with the idea of rendering more adequate justice to the individual, is creating interest on the big American systems. It was the origination of Mr. Grant Hall, general manager of the western lines, with about 40,000 employees under his direction. Sir Thomas Shaughnessy, at family banquets has, before now, expressed regret that good men might be overlooked, notwithstanding the fact that the company was on the keen lookout for the men who were to come after the present officers. It has been felt that while the men close at hand could be measured as to capacity, the thousands at a distance, working on all parts of the line, extending for thousands of miles, might be overlooked in spite of the most undeniable qualifications.

Mr. Hall appoints trustworthy persons who shall go over the western system regularly, watch the men, themselves unsuspected, and report, not their bad, but their good qualities; how they do their work; how they conserve the interests of the company; how they show their zeal. If bad, things must be reported, those against whom the black mark is made will have a chance to be heard before judgment is rendered. In this way, it is believed the merits of the men will be more certainly discovered, and, being discovered, promotion will follow upon the discovery—when that is possible.

The idea, which is even now being put into effect, is regarded by the big American systems as at once novel and excellent. The wonder is that it was not tried before. The men who are at the elbow of the president or at the heads of departments are, of course, noticed and promoted, which may be just enough; but those who are not seen, have not the same chance and yet they might be just as capable as the more favored ones.

This has been felt to be a grievance from the beginning; but a grievance which could not, apparently, be remedied. Mr. Hall has found a way. He brings each employee close by the report he will receive respecting him. Of course, the investigation which the secret inspector can make must necessarily be superficial; nevertheless, it will have value. They can see where there is courtesy; a willingness to help; zeal for the service; and these enter into character.

ANALYZING AND CHARTING YOUR ORGANIZATION.*

By A. R. Rosenblatt.

IT is one of the inefficiences of many large organizations that executives either do not know or will not admit the abilities of minor employees to fuller recognition. Clerks are permitted to go on clerking for year and years without any attempt being made to utilize in other fields of knowledge of the business which they have accumulated. Worse yet, latent abilities which many minor employees possess are permitted to go unused to the detriment both of the house and the employe.

So many men and women drift into the first job that comes to hand out of sheer necessity. They haven't the time or opportunity to analyze themselves, to find wherein their greatest strength lies, and to seek until they obtain the post that offers the best opportunity for the good work they are best fitted for. There is to-day more waste in potential human ability by workers and employers than there is waste of material, and as the majority of young workers do not stop to analyze their possibilities, it is up to the employer to do this and see that the knowledge and ability of his organization is developed and used, for the mutual benefit of employed, employer and the work itself.

There are many live firms who are constantly doing good analytical and edu-

*From an article in the Efficiency Magazine.

cational work among employees in this direction. One concern, for example, has a plan for classifying and recording every employee immediately upon entry into the organization, under the following headings, the basis for decision being the employee's own account of himself, experience, habits and the impression produced in an interview:

(a)—Physically strong vs. Physically weak.

(b)—Mental strength vs. Inclination to manual labor.

(c)—Settled vs. Roving temperament.

(d)—Indoor vs. Outdoor workers.

(e)—Directive vs. Dependent nature.

(f)—Originality vs. Imitativeness.

(g)—Detail vs. Large-plan men.

(h)—Adaptability vs. Obstinancy.

Such information is an excellent index to determining whether the individual is applying for the job for which he is best fitted, or whether he would not be more efficient in another post.

Another house keeps permanently a chart for each employee. This records in one column the individual's own estimate of his qualities, abilities and characteristics upon entering the organization, and is checked from time to time by recording his actual performance. This chart lists such factors as—

Physical Characteristics.

Age, height, weight, appearance, general health, and any defects of sight, hearing, etc.

Mental Qualities.

Education, experience, concentration, observation, memory and what specific ability ever manifested—in mechanical, artistic, literary or scientific directions?

Character.

Industry, truthfulness, decision, thoroughness, carefulness, enthusiasm, loyalty, morals, aggressiveness, self-confidence, patience.

If a correctly kept chart of this kind were available to every executive, he would find it possible to draw from his own organization unlimited means for development of business and of the individual.

MACHINE DICTATION VS. STENOGRAPHERS.

ONE of the most exacting and convincing tests of the efficiency of dictation machines, in comparison with the stenographic method of handling correspondence, has been made in the office of a well-known Massachusetts concern.

In this test the precise number of words written within a given time was recorded, through the medium of a timekeeper, who made an actual count of the production of each employee. The test extended over six days and a record was kept of the work of nine stenographers and four dictation machine operators, all of whom were regular employees of the company conducting the test, consequently all were equally familiar with the work. The four dictation machine operators were under a handicap, as all four were novices in the use of the system.

The result of the test showed that the nine stenographers working 11,478 minutes during the six days on this particular kind of work turned out 219,128 words, or an average of 19 words per minute, while the dictation machine operators, working 11,865 minutes, in the same six days turned out 341,571 words, or an average of 29 words per minute.

In other words, under the dictation machine system with only 44 per cent. of the working force, 122,000 more words were written in one week, or 10 words more per minute.

ANALYZING SCIENTIFIC MANAGEMENT.

SCIENTIFIC management is being investigated by the Industrial Relations Committee at Washington, and well-known efficiency engineers and labor men had an opportunity to give their individual viewpoints on this much discussed system. According to the New York Evening Post, the following points at issue were clearly developed:—

The idea of the whole movement, according to Frederick W. Taylor, is to increase the comfort and well-being of the workers. Under his system, he declares, thousands of men are getting higher wages every year—steadily growing more prosperous. That is the inevitable result, according to Mr. Taylor. The saddest thing in the whole industrial world, he told the commission, is the idea now prevalent among working men that they should curtail their productivity, or "go slow." What the workers need is more goods, and where will goods come from if the workers do not produce them? he asked. It was to meet this situation that the idea of scientific management was developed.

Carl C. Barth, a consulting engineer of Philadelphia, declared that he would have no objections to unions if the union leaders would come to him for instructions and study the system for two or three years before they demanded the privilege of having a voice in its development.

Labor Leaders Suspicious.

Thus, olive branches, or twigs at least, were held out to organized labor by the efficiency engineers. Nevertheless, the labor men did not seem to be impressed. They were frankly suspicious of the whole movement. All of the reports that came to them from the employees where the experts had had their way were exactly contrary to the opinions expressed by the experts themselves. Instead of liking the system, they declared that the men were opposed to it in every case. They declared that it was just another scheme of speeding up the workers and getting more profits out of them. They did not think much of a scheme that was going to double production of the workers, and they frankly stated that they had no confidence in Mr. Taylor's statement that there would be work enough left for all of them.

In answer to the engineers' criticism of the labor unions that they had not tried to understand scientific management, the unionists retorted that the experts had never tried to explain it. "If these men believed in collective bargaining, as they say they do," said A. G. Berres, secretary of the metal trades department of the American Federation of Labor, "it is peculiar that they have never knocked at the door of a labor convention and asked an opportunity to explain their system. They have never even gone to a local body and asked for a hearing."

The thing that was evident throughout the hearing was that it will take a long time of fair dealing to blot out a suspicion that has been engendered in the minds of labor men by the speeding methods under the old piece-rate system which involved frequent cuts in the rate. It was evident, too, that the efficiency engineers are better engineers than they are economists, for it developed under the questioning of members of the commission that the only assurance they offer that the wage rate will not be cut under their system is that such a procedure is in the long run unwise and very unscientific. They seemed to insist that they had found a solution for the conflict between labor and capital over the division of profits in industry, but they were unable to explain either how capital could be induced to pay and keep on paying what is "fair" or how labor could be induced always to be content with that and never ask more.

Brandeis Would Start With Unions.

These difficulties were faced more frankly by Louis D. Brandeis, who was the last advocate of scientific management to appear before the Commission. Mr. Brandeis would start with organized labor instead of introducting the system first and then attempting collective bargaining. Labor will not be safe at any point, Mr. Brandeis stated, either at the time of the introduction of the system or when it is under way, unless it is organized and able to insist upon a consideration of its views.

Mr. Brandeis believed that some of the experts had been at fault in not

(Continued on page 532.)

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

With the further development of this course in arithmetic, it will be found by those who have followed the introductory lessons and profited by them that the various practical applications resulting from the succeeding lessons will be easily observed and their time and labor-saving features so appreciated as to be adopted at every available opportunity.

MENSURATION.

MENSURATION is that branch of geometry which treats of the measurements of lines, surfaces and solids.

The area of a surface is the number of unit squares it contains, usually expressed in square inches, square feet or square yards.

The expression sq. inches, should not be confused with the expression inches square; for instance, while an inch square would represent one sq. inch, the expression—3 inches square means a square figure that measures 3 inches on a side, and would represent $3 \times 3 = 9$ square inches.

The area of any triangle equals one-half the base multiplied by the height.

The area of any irregular figure bounded by straight lines can be found by dividing the figure into triangles and finding the area of each separate triangle; the sum of all the triangles equals the area of the figure.

To find the circumference or diameter of a circle.

Circumference equals the diameter multiplied by 3.416, and diameter equals the circumference divided by 3.1416, or by the formula (Chart 18:

$$p = d \times 3.1416 \text{ or } d = \frac{P}{3.1416} = .3183p.$$

The area of a circle equals the square of the diameter multiplied by .7854 or by formula

$$A = \frac{Nd^2}{4} = .7854d^2$$

Example:—A certain belt has a speed of 1,250 ft. per minute, what is the diameter of the driving pulley if the speed of the driving shaft is 160 revolutions per minute?

The circumference of the pulley will be the surface speed in inches, divided by the speed of the shaft, or

$$\frac{1250 \times 12}{160} = \frac{375}{4} = 93.75 \text{ inches, then}$$

$$\text{diameter} = \frac{93.75}{3.1416} = 29.8 \text{ ins., or a}$$

30-in. pulley.

Example:—If the mean effective pressure in an engine cylinder be 65 lbs. per sq. in., and the diameter of the piston is 16 ins., what is the total force acting on the piston?

The total pressure will be the pressure per sq. in. multiplied by the area of the piston, or $65 \times .7854\ d^2 = 65 \times .7854 \times 16 \times 16 = 13,069$ lbs., or $6\frac{1}{2}$ tons.

To find the diameter of a circle when the length of a chord and the height of the segment are known. (See Chart 18.)

The height is to half the chord as half the chord is to the diameter minus the height. $h : .5c = .5c : a$

or diameter $= [(.5c)^2 \div h] + h$.

Example: To find the diameter of a broken flywheel. (See Chart 19.)

This may be obtained either graphically or by calculation. Select three points (a) (b) (c) upon the rim of the broken section; then with radius greater than half the distance a.b.) describe arcs intersecting at (f) and (g). Similarly from (b) and (c) describe arcs intersecting at (d) and (e). The production of these bisecting lines will intersect in the centre (o).

By calculation: If in the broken section (Chart 19), the length of the chord (1—2) equals 18 inches, and the height (3—4) equals 1.125 inches, what is the diameter of the flywheel?

By formula:—

diameter $= [(4\text{-}2)^2 \div (3\text{-}4)] + (3\text{-}4)$ or $(9^2 \div 1.125) + 1.125 = 73.125$ inches.

To find the length of a spiral.

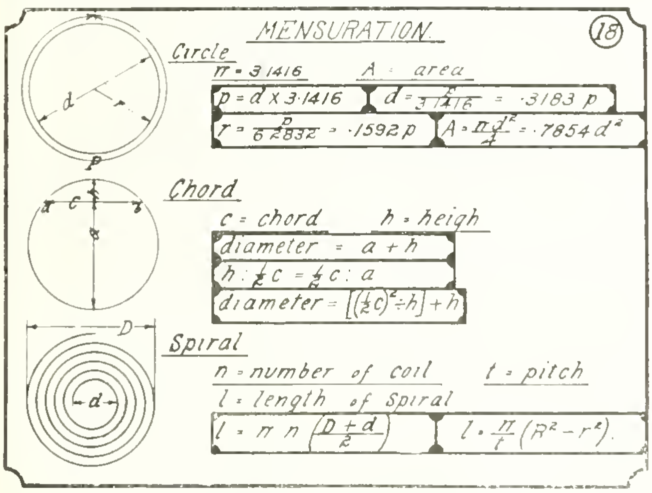
Multiply one-half the sum of the large and small diameters by 3.1416 times the number of coil.

Example:—Large diameter of a roll of belting measures 15 inches, the inner diameter 3 inches, and the number of coils equals 24; what is the approximate length?

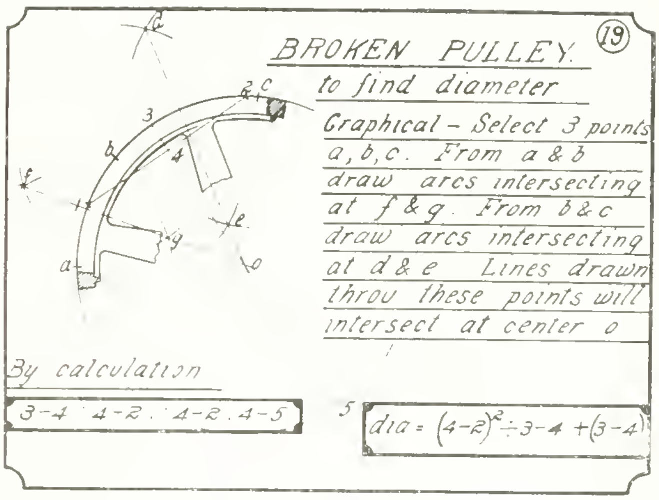
$$\text{By formula: } l = \pi n \left(\frac{D+d}{2}\right) =$$

$$3.1416 \times 24 \left(\frac{15+3}{2}\right) = 678.61 \text{ in. or}$$

56 feet 6 inches.



ARITHMETIC CHART 18.



ARITHMETIC CHART 19.

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Pulp and Paper. In pulp and paper circles it is thought that a profitable business in the Orient may be developed by the pulp and paper mills of British Columbia. At present a number of these mills are closed down, but it looks as if there might be a steady development in many lines of business with Southern Asia, China and Japan.

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

ARRANGEMENT OF STOPS FOR TURNING ON THE LATHE.

By Frank H. Mayoh.

ON THE average engine lathe the question of some means to automatically stop the carriage when turning lengths or facing shoulders is a baffling one inasmuch as these lathes are not usually fitted with stops, or at the most but a single one is provided.

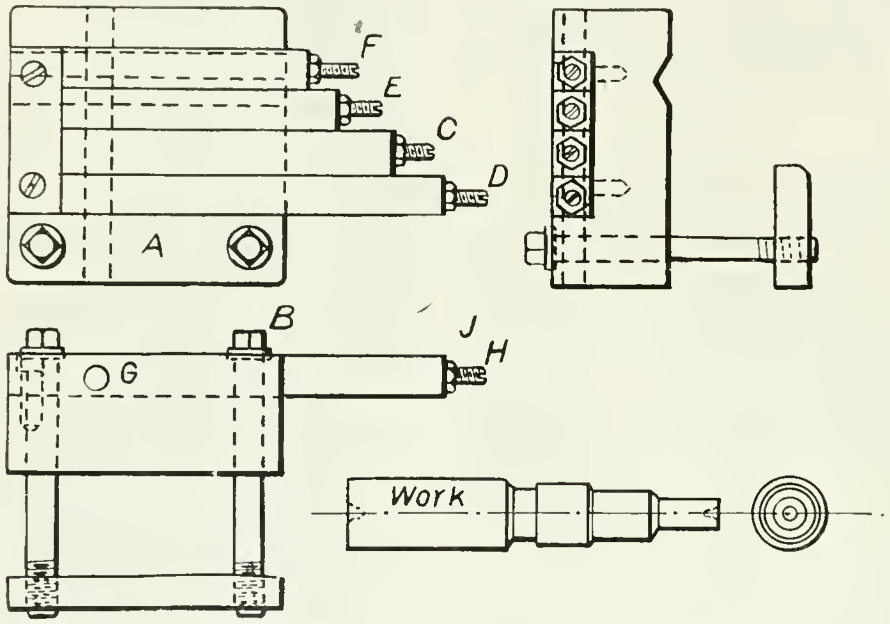


FIG. 1. DETAIL OF STOPS FOR TURNING ON THE LATHE.

In dealing with work similar to that shown in Fig. 1, it will be seen that to measure each length as required for each step on each piece would be quite a problem, and a laborious process. To get over this, the stops shown in place on a lathe carriage slide were devised.

The device consists of a bracket A (which is also shown in Fig. 2), fastened to the side of the lathe in a manner similar to a clamp by the two screws B. In this bracket there are mounted four blocks of various lengths, viz: C, D, E and F, which are swung on the pin G, and carry setscrew H and the necessary check nuts J. These are used as follows:—

When starting to turn the piece indicated in Fig. 1, all the swinging stops are down parallel with the slide as shown. It will also be noticed that the stops are of different lengths. Starting to turn, we proceed until the lathe carriage reaches the first stop, which is D—all of the stops having previously been set to the correct length by a scale before starting to cut. Lifting the end of this stop, it is swung on the hinge pin through about 120 deg., until it rests upon the edge of the bracket, where it is out of the way. We now proceed to the second step and turn up to the next stop, C, which is shorter in length, and so on with stops E and F until the piece is completed. The same cycle of operation is gone through on the remaining pieces, thus saving considerable trouble and eliminating the chances for error which the continual measuring and setting up or lack of proper stops always entails.

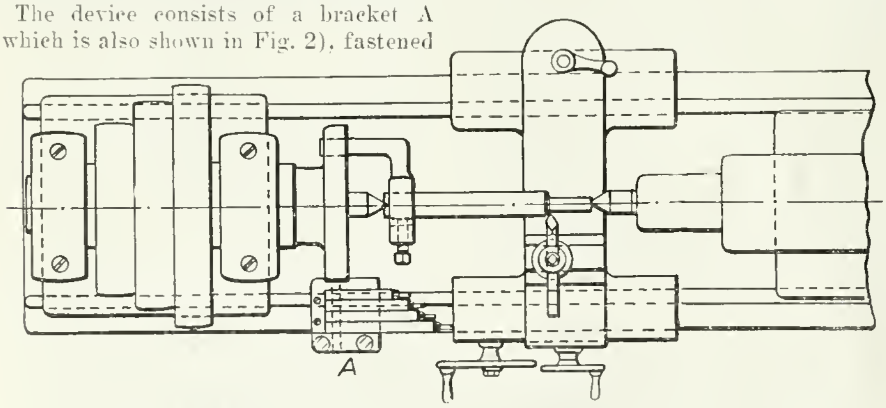


FIG. 2. ARRANGEMENT OF STOPS FOR TURNING ON THE LATHE.

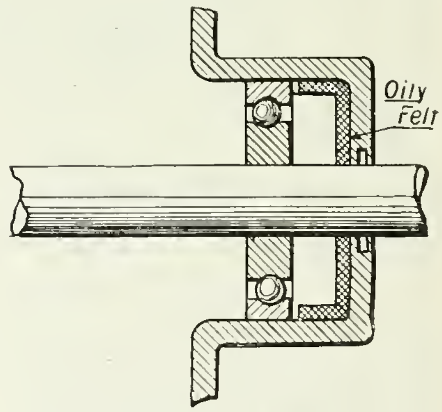
This device might be improved by putting square heads or in some way increasing the bearing surface on the ends of the studs.—Editor.

SCHEME FOR CATCHING DIRT IN BALL BEARINGS.

By N. G. Near.

TO keep dirt and grit out of your ball bearings, keep the balls covered with a thin coat of oil sufficient to prevent them rusting, and your principal ball-bearing troubles are eliminated.

Ball bearings are now made for almost every machine where minimum friction is desirable. For shafting transmission they are made particularly strong, rugged and durable. There are many varieties of dirt shields for protecting the balls and races, some of them very effective, but to be absolutely sure that a minimum of dust will filter into the vital parts, it is a good plan to glue felt around the interior of the shield as shown in the sketch herewith and make it moist with oily graphite or other lubricant that will not dry. When a dust particle enters, it will be thrown against this trap by air currents set up by the rotating balls. Thus, whether the bearing is in use or not the dust particles have little chance to get to the surfaces where harm might be done. After several years of use the felt can be rinsed clean with gasoline.



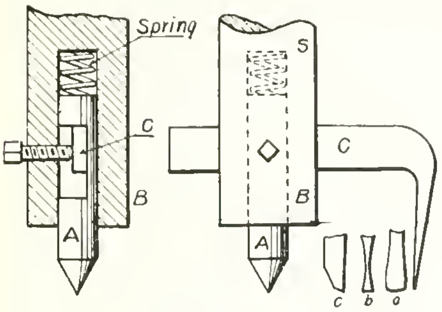
CATCHING DUST IN BALL-BEARINGS.

CUTTING FIBRE WASHERS IN THE DRILL PRESS.

By A. V. Francis.

THE illustration shows a form of cutter used in the drill press for cutting fibre washers. There was not enough of this kind of work to warrant having dies made for each size of washer, so that an adjustable cutter became expedient. The shank B fits the drill press spindle or chuck, and is bored to relieve the centre A and a spring behind it. It is also mortised for a cutter bar C. The centre can either be cut away to go around the cutter bar or can be slotted to go each side of it.

If the washers be thin, a knife edge like (a) will cut them nicely when laid on a board, but if too thick for this, a cutting edge can be made as (b) with a rake and clearance like (c) to act just



CUTTING FIBER WASHERS IN THE DRILL PRESS.

as a cutting-off tool. The centre holds the sheet of fibre against the board on the drill-press table, and is forced into the holder as the cutting knife is fed down into the work. It will be readily seen that this form of cutter can be varied in many ways, any of which will no doubt answer the purpose.

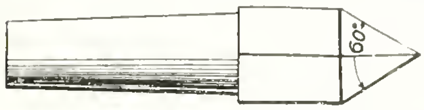
An improved form of this apparatus is made with two cutters instead of one, so that the hole and periphery of the washer may be cut at the same time. The centre also is more easily made long and thin so as to go down into the work as the tool is fed. If the cutters be set at a slight angle with the circumference cut, the burring of material will be done to the scrap and the work will be comparatively smooth. Many other materials, such as mill board, friction paper, etc., can be cut with this fixture.—Editor.

MILLLING SQUARE CENTRES.

By J. Davies.

HERE is an interesting workshop problem which may be of interest to Mr. Rodgers of the "Workshop Arithmetic" series and others. It will serve to illustrate one of the many cases where shop arithmetic in a practical form could be of considerable help to the mechanic as well as serve to make his work more interesting.

The problem consists of setting up square centres for the lathe in the milling machine so that the angle across the corners will be exactly 60 degs. It is easily seen that the angle across flats is not the same as across the working edges. Most mechanics would accomplish this by the cut and try method while others would lay it off on the



MILLING SQUARE CENTRES.

drawing board and transfer the angle; but very few could set the dividing at the correct angle to give the desired result with assurance.

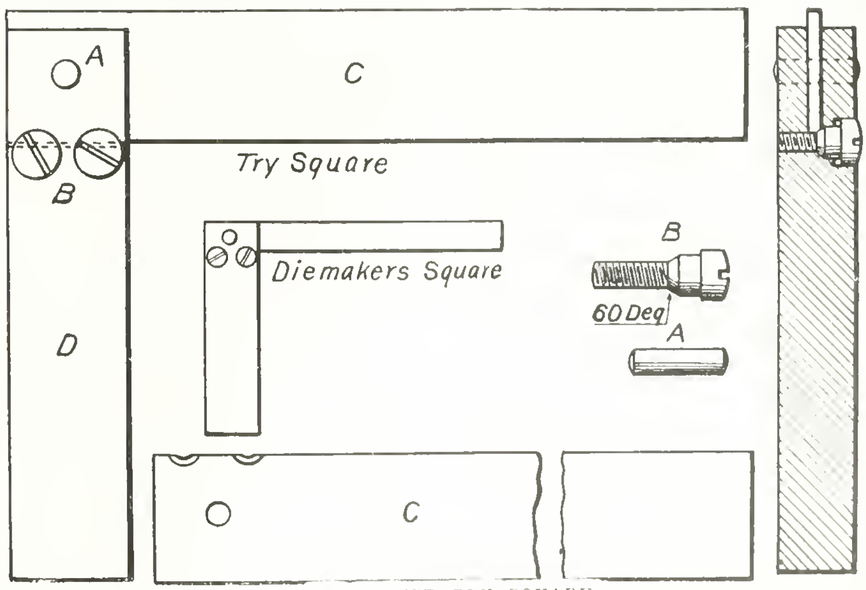
This is a practical problem that I have been up against and thought it would be a splendid example to prove the value of workshop arithmetic.

AN ADJUSTABLE SQUARE.

By E. J. Charp.

THE accompanying sketch illustrates a very simple form of adjustable square. It can be set within a range of 10 degrees and, with careful designing and making of parts, will be as rigid as a solid square for all practical purposes.

As will be seen, the blade C and stock D are made and finished separately, which greatly facilitates the grinding and truing operations. The blade pivots about the hardened pin A, which is made with a generous bearing surface. The locking and adjusting device consists of



AN ADJUSTABLE SQUARE.

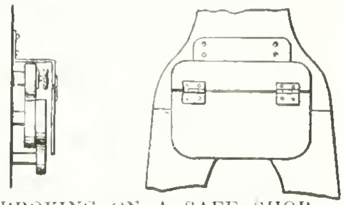
two special screws B, with shoulders beveled off at 60 degrees. The blade is similarly countersunk on the edge at the same angle to match the cone surfaces of the screws. All parts are hardened.

The object of this adjustment is not to produce a bevel protractor, but to provide a ready means of correcting the effect of accidents that will, as all mechanics know, happen to the strongest tools. The small square shown is a practical application of this tool to die work. The blade can be set to any desired clearance angle with little trouble, and can be rigidly held in this position.

IMPROVING ON A SAFE SHOP.

By D. A. Hampson.

THE safety engineer left our shop as a completed job — completely "safetyized," but in some instances not very conveniently arranged. Among other things, the guards on the lathe change gears were made rigid and in one



IMPROVING ON A SAFE SHOP.

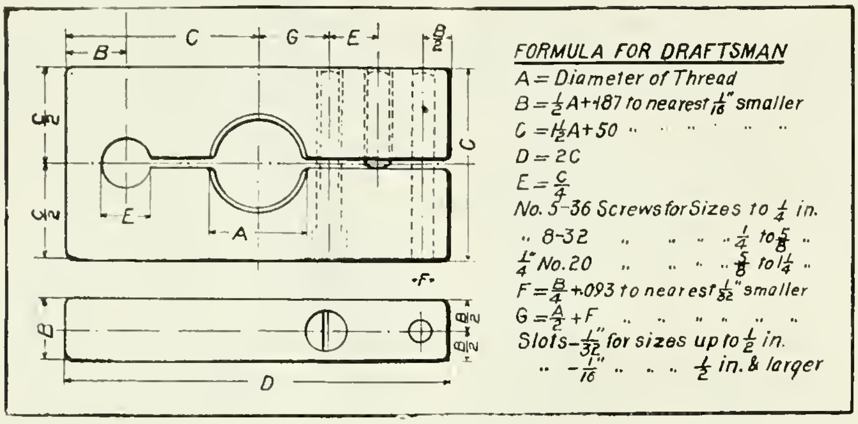
piece, which necessitated its being made large enough not only to cover the gears, but to permit their removal and replacement.

This arrangement was removed and a guard made as shown in the sketch. It is self-explanatory, and consists of a piece of 1/8 in. sheet iron bent in the shape of the letter Z and to which is hinged a loose flat piece of the same material. To change the gears, the flap is raised to a vertical position, where it remains just balanced. Should the operator forget to lower it, over-balance results, and it falls of its own accord. Thus, the safety expert succeeded indirectly in that his attempt stirred the gray matter of the ordinary mechanic.

DRAWING ROOM DATA SHEET.

By L. A. W. D.

IT is well known that the average draftsman and tool designer in particular is not partial to compilations of formulae; still, the simplicity of the scheme herein illustrated should appeal to any designer. It is particularly useful for drawings of gauges, reamers, taps, or other tools which are similar in general form for a number of different sizes.



DRAWING ROOM DATA SHEET.

Two tracings are made, the one for the drawing room being dimensioned as shown in the sketch. These prints are made in loose leaf form to fit the notebook of the draftsman. The tracing for the shop is similarly made, except that in place of the formulae the blocked out space is left blank and the desired dimensions simply filled in on the blue print. As an example, a set of sizes for a 3/4—10-thread gauge is here carried through. A=3/4—10; B=.562; C=1.312; D=2.625; E=.328, nearest 1-16=.312; F=.1406, nearest 1-32=.125; and G=.50.

This system has been in successful use for four years by one of the largest automobile factories, and has been a large factor in the attaining of uniformity in shop tools.

TENSION ON CYLINDER COVER STUDS.

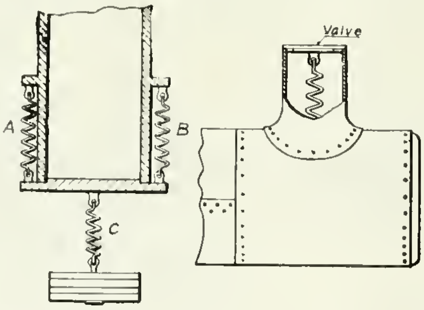
By C. N. Roach.

IN a former issue of your journal, Mr. Rogers proved to the satisfaction of quite a number of readers that if the studs were screwed up with a tension of 1,000 lbs. each and the full steam pressure, amounting to 2,000 pounds, be turned on, the total tension in the studs would be 4,000 lbs. This I do not altogether agree with.

In my opinion there can be no increase of tension on the studs when the steam is admitted to the cylinder. This theory I illustrate with springs as substitutes for studs and the steam pressure. If the cover be held in place with two springs, A and B, each under a tension of 1,000 lbs., the steam pressure can be readily represented by regulating the tension in the spring C.

If the tension in C be raised to 1,000 lbs., the tension on the other springs will still be 1,000 lbs. each. If raised to slightly more than 2,000 lbs., we will begin to note a deflection of A and B, as this will exceed their initial tension. This should corroborate the conclusions of Mr. Jones to the effect that the tension of cylinder studs does not increase until the total steam pressure becomes greater than the tightening up tension in the studs.

Another simple illustration is in the form of a boiler and safety valve. If there were any increase in the tension of the spring it would deflect and steam would blow off before the required pressure was reached. As the steel of the studs is more or less elastic if not seriously overworked, there is no reason why these cannot be cited as parallel cases.



TENSION ON CYLINDER COVER STUDS

STRENGTH OF WIRE ROPE.

THE results of an investigation of the strength and durability of wire rope made by Prof. G. Benoit at the Technical High School at Karlsruhe, are recorded in a recent issue of Glückauf. The experiments were made with a patented cast-steel wire, 1mm. diameter, which showed a strength of 247,000 lbs. to 225,000 lbs. per square inch, with 227,000 lbs. per square inch guaranteed. The wire was tested singly and also twisted to a strand of seven wires, 3.1 mm. diameter, there being six steel wires and a core of a softer wire of a strength of about 122,000 lbs. per square inch. This rope withstood a pull of 1,770 lbs. The soft core did not break, but stretched considerably.

Three of the strands were then combined to form a rope of 6.8 mm. diameter, and five to form a rope of 8.5 mm. diameter, the latter with a hemp core. The wires and ropes were bent over a pulley through an angle of about 90 degs. at the rate of 1,000 turns per hour, the turn meanings the bending of the wire from the straight and then back to the straight again. The stress to which the wire under test was generally subjected was 11,200 lbs. per square inch. The single wires stood 198,710 bends, and twisted strand had one or two wires broken after 44,800 and 47,190 bends.

The first experiment was made with a pulley 6 7/8 in. diameter, and a larger pulley was then substituted, 7 1/8 in. diameter. On this the single wire stood 122,000 to 200,000 bends, while the twisted strand showed breaks in three wires after 40,860 bends. The cable of three ropes had one wire broken after 22,860 bends, and is said to have been destroyed after 36,440 bends. The five-rope wire began to fail after 35,000 bends, and was given up after 40,000 bends. The conclusions so far seem to indicate that twisting leaves considerable strains in the wire rope and especially in those of high-class steel.

ANALYZING SCIENTIFIC MANAGEMENT.

(Continued from page 528.)

seeking an opportunity to explain their proposals to organized labor. On the other hand, the labor men have been at fault in condemning the system before they understood it.

"Scientific management offers the same opportunity to-day," said Mr. Brandeis, "as the opening up of Western land did fifty years ago. The existence of free land wasn't a solution of labor problems, but at the time, at least, it was a way out. Now the free land is all gone, and we are confronted with a new problem. Scientific management offers a new way out, but there is no possibility of a final solution so long as we have in juxtaposition political democracy and industrial absolutism. We can never curtail industrial unrest until the workers have a share in industry."

The D. E. Cleaton Co., Coristine Building, Montreal, Que., have been appointed sole agents for Canada for Henry Berry & Co., Leeds, England, makers of hydraulic presses.

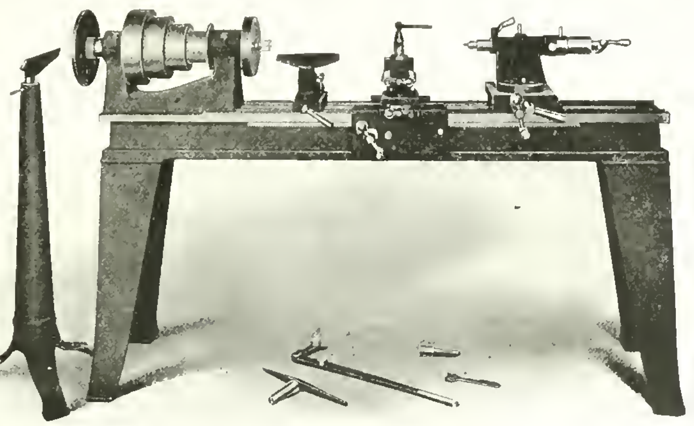
DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

PATTERNMAKERS' LATHE.

THE description and illustration refers to a patternmaker's lathe recently brought out by the J. G. Blount Co., of Everett, Mass. The machine is of 16-in. swing with a 6-ft. bed.

The spindle is hollow and made from high carbon steel and runs in self-oiling bronze bearings. The outer end of the spindle is threaded for a face plate in order to turn work of large diameter, and a tripod rest is furnished to be used in connection with same. In addition to the usual hand-rest the lathe is equipped with a carriage having rack and pinion feed. This carriage has hand cross-feed and a compound rest so that feeds in all directions may be had.



BLOUNT PATTERNMAKERS' LATHE

The tailstock has screw and lever feed, and is provided with a graduated swivel base so that any degree of taper may be turned or bored; a taper pin is provided to rectify the alignment. The base of the tailstock is provided with a slide, and by means of a ball handle, as shown in front, the tailstock may be fed crossway of the bed, a feature very desirable for boring or turning. A plain countershaft with tight and loose pulleys, or a friction countershaft with two friction pulleys is furnished with the lathe.

SELF-OILED 20-INCH ALL-GEARED DRILL AND TAPPER.

THE All-Geared Drill, of the Barnes Drill Co., Rockford, Illinois, has from its inception been built heavier, stronger and much more powerful than an ordinary drill of same swing, and with the self-oiling system now added it embodies another element that contributes to the highest state of mechanical efficiency. The strength, power and enduring qualities of the self-oiling all-geared drill makes it possible, it is claimed, to attain the maximum speeds and feeds of high speed twist drills.

Every bearing (aside from the spindle sleeve) is self-oiled, while there are eight changes of geared speeds and eight changes of geared feeds, all under instant control of the operator from the front of the machine. Besides there being no cone or inherent belts to buy, to slip, to shift or to maintain. It is positive and a result-producing unit. All gears are fully inclosed, meeting requirements of the modern safety laws.

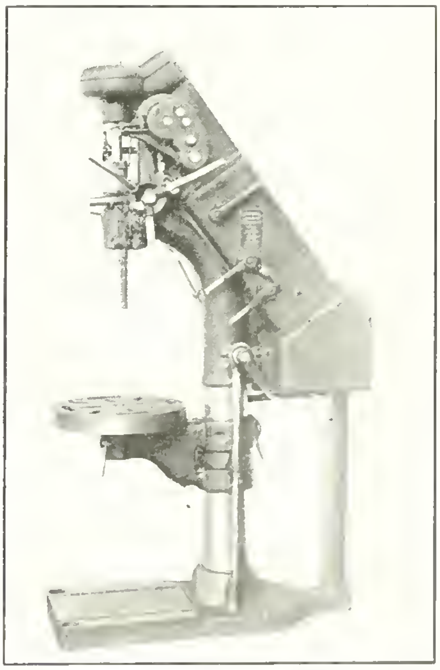
The drill is furnished with back gears, geared feeds and automatic stop complete, or with geared feeds and automatic stop only. Reversing friction clutch gears and automatic reverse may be supplied when required, while all styles can be furnished with motor drive. For fast high-speed drilling on sizes under 1-in. special crown gearing to double spindle speeds can be furnished. The machine will handle high-speed twist drills from $\frac{1}{4}$-in. to $1\frac{1}{4}$-in. at suitable speeds and feeds.

The frame of the drill is unusually heavy and strong, the back brace making it an exceedingly rigid machine. The spindle is made of the best quality of machinery steel, double splined and ground to size, fitted with a special ball thrust bearing of great strength. The spindle is counterbalanced, and the nose is extended to bring drift hole below sleeve. Graduations on sleeve are in inches and millimeters.

The transmission gears are located on the diagonal shafts, and are cut from special chrome nickel steel, bar stock, and tempered, having a tensile strength of 270,000 pounds per square inch. There are eight changes of speeds (four without back gears), any one of which is easily and quickly obtained without stopping the drill, by simply operating the proper shifting lever, conveniently reached from the front. Proper and convenient means of lubrication are also provided.

The back gears are operated by a small lever accessible from the front of the drill, and may be instantly engaged or disengaged while machine is running. There are eight changes of geared speeds, and any feed may be instantly secured while the spindle is running idle, by placing the small index lever (directly in front of the operator) in the proper notch or segment, feeds being indicated in plain figures.

All bearings, aside from the spindle sleeve and cross spindles, are continuously oiled automatically. Oil is pumped by a geared pump in the reservoir of the machine and distributed constantly to all gears and bearings, including the crown gears and feed box.



20-IN. SELF-OILED, ALL-GEARED DRILLING AND TAPPING MACHINE

This self-oiling system is manufactured under license from Kearney & Trecker Company, owners of U. S. Letters Patent No. 834,063, dated October 23rd, 1906. An automatic stop giving full spindle travel is also furnished, while a safety device prevents overloading and reduces

the breakage of twist drills to a minimum.

A star wheel lever controls the hand feed, and is entirely different from the common ratchet lever. It operated through a pinion running into an internal gear in the ratio of 4 to 1; thus the star wheel handles are equivalent to a common lever of four times their length. This star wheel also acts as a quick return lever, eliminating the use of a ball handle for the purpose. Geared motor drive may be supplied when desired, for which a 2-h.p. motor, speed about 1,200, is recommended.

For tapping, the friction clutch gears give reverse speed of $1^3/_4$ to 1, and these gears are on the driving end of the machine—not on the spindle—a strong point.

The machine has automatic reversing mechanism, a very desirable feature, particularly for depth tapping. The trip can be set so that the instant the tap reaches depth desired, the spindle will automatically reverse, backing out at an increased speed. Again, the shifting lever can be set so that when tripped automatically (or by hand), it will return to neutral position, thus stopping the spindle instantly instead of reversing same. The small hand trip lever shown is always ready for instant use if desired to reverse or stop spindle at any point in the operation. Leading features of the specification are as follows:—

Height of drill, 70 ins.; column to centre of table, $10^1/_4$ ins.; maximum distance, spindle to table, $26^3/_4$ ins.; diameter of table, 16 ins.; vertical travel of spindle, 10 ins.; vertical travel of table, 16 ins.; floor space about $37^1/_2$ by 16 ins.; weight complete about 750 lbs.

J. H. Plummer, president of the Dominion Steel Corporation, leaves for England shortly.

COMBINATION PATTERNMAKERS' MACHINE.

THE Gardner Machine Co., Beloit, Wis., are introducing a new product known as their No. 20 Combination Patternmakers' Machine, and concerning same the accompanying text and illustrations give prominence to the leading features.

The disk-wheel is 30 inches in diameter and runs at 950 r.p.m. It is faced with a "netbac" garnet disk, which is attached firmly without the use of a wheel press or removing the wheel from the spindle. The universal work table is mounted on a dove-tail slide back of the cutting plane of the disk wheel, and may be raised or lowered and locked instantly at any desired height. Being counterbalanced by a weight within the machine base this operation can be done quickly and without exertion. The table also has angular adjustment to the face of the disk wheel, while a graduated segment at the head of the table accurately shows the angle and one turn of a hand locks the table top in the desired position. The axis of the table is such that its inner edge always remains close to the disk, regardless of the angular position. The importance of this point is most noted when working on small pieces.

There are three work gauges which accompany this table and which are of much practical value. The universal angle gauge is especially efficient in producing compound angles and squaring up pieces, and as its name implies, the duplicating gauge is used in producing duplicate pieces and in generating parallel surfaces. The circle generating gauge makes it practical to do much round work which usually requires a lathe. By its use many external curves can be rapidly and accurately generated. All of these fixtures are convenient, accurate and quick-acting.

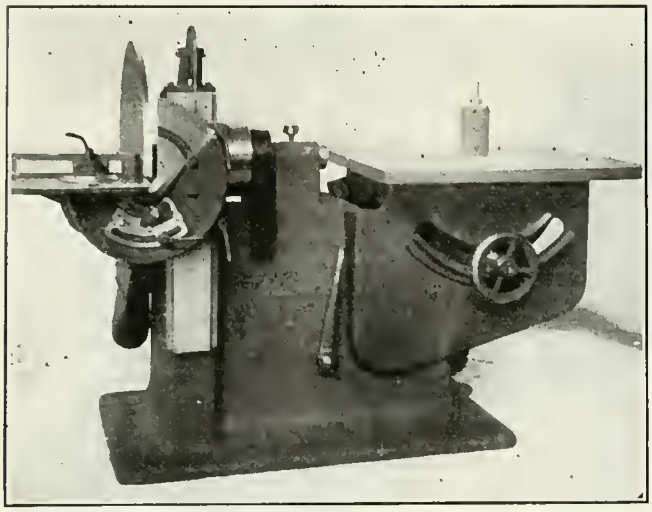


FIG. 1. GARDNER COMBINATION PATTERNMAKERS' MACHINE.

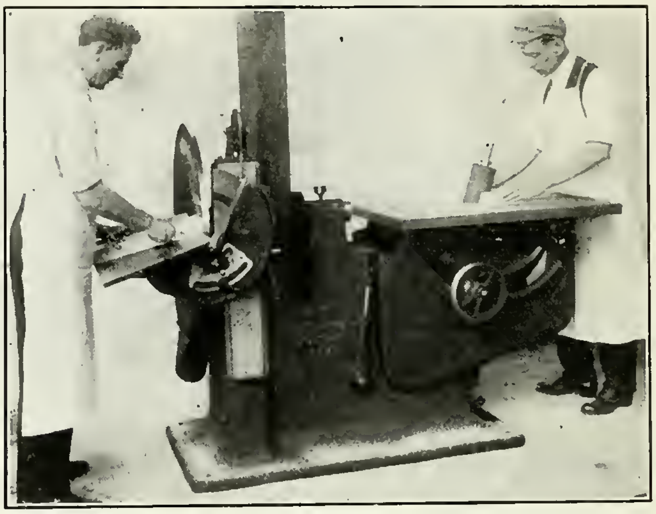


FIG 2. GARDNER COMBINATION PATTERNMAKERS' MACHINE.

The practical uses of the sanding roll have been already proved on the Gardner No. 26 Roll Sander—to generate and finish internal curves. Being roughly cut out on a bandsaw, the piece is finished to proper dimensions on this sanding roll. It does much of the work usually performed by hand carving and on lathes, and in a fraction of the time. The sanding roll is driven by a friction disk, and inasmuch as four different diameter rolls are furnished, all of which are seven inches long, there must be provision for altering the roll spindle. In other words, the 2-in. roll must run at a higher rate of speed than the 6-in. roll. A roll spindle speed variation of from 2,000 to 6,000 r.p.m. is therefore provided.

The rolls are made of cast aluminum and are perfectly balanced. They are faced with a strip of "netbac" garnet which is cut at an angle. This angle makes a spiral seam from end to end of the roll and prevents any "pounding" which would probably result with a straight joint. To remove a worn out "netbac" garnet strip, the roll is simply soaked in cold water for about five minutes, after which the strip can be readily pealed off.

Another feature of importance is that this roll has an up-and-down reciprocating motion of $1/8$ in. This action prevents cutting ridges or grooves in the work and also assists in the faster removal of stock. To produce this motion, the roll spindle engages with a pivoted fork with ball bearing support working over a cam, all of which is positively driven by helical steel gears. The weight of the entire spindle and roll is supported on ball bearings.

Perhaps one of the most distinctive features of the roll end of this machine is the fact that angles can be finished just as accurately and rapidly as straight surfaces. This is accomplished

by tilting the roll rather than by changing the position of the table top. The table top always remains flat regardless of whatever angle the operator may be working. It is obvious that this is the natural and proper position. The angle at which the roll is tilted is accurately registered on a graduated segment located directly behind the locking handwheel. If the main spindle which carries the disk wheel is in operation, the roll can be started or stopped as occasion requires. The clutch lever controlling the roll, is at the centre of the machine in front, as will be noted in both Fig. 1 and Fig. 2. A hinged door at back of machine base makes the interior of the machine readily accessible.

The disk wheel is always provided with an efficient dust hood, while the sanding roll throws but little dust into the air. Owing to the small diameter of these rolls, the grindings are practically all laid out on the top of the table and can be easily brushed aside. In some classes of work, however, it would be advisable to make provision for dust. This is best taken care of by suspending an exhaust pipe, with enlarged opening, directly above the roll.

The No. 20 machine is made with the main driving spindle in either babbitt lined bearings or in highest grade ball bearings. As shown in the accompanying illustrations, the plain bearings are used. The machine is also well adapted to direct motor drive. If such drive is desired, the motor is mounted on a bracket at the rear of the machine base and connected to the main driving spindle by silent chain. A few of the main specifications of the machine are as follows:—

Disk wheel, 30 inches diameter; disk wheel work table, 36 inches long by 15 inches wide; table for sanding roll, $31\frac{1}{2}$ inches by 36 inches; roll spindle, 1 inch diameter; size of rolls, 2, 3, 4 and 6 inches diameter by 7 inches face; speed variation of roll spindle, 2,000 r.p.m. to 6,000 r.p.m.; speed of machine spindle, 900 r.p.m. The power required to operate the machine at full capacity is 5 h.p., and the operating floor space is approximately 6 feet by 12 feet.

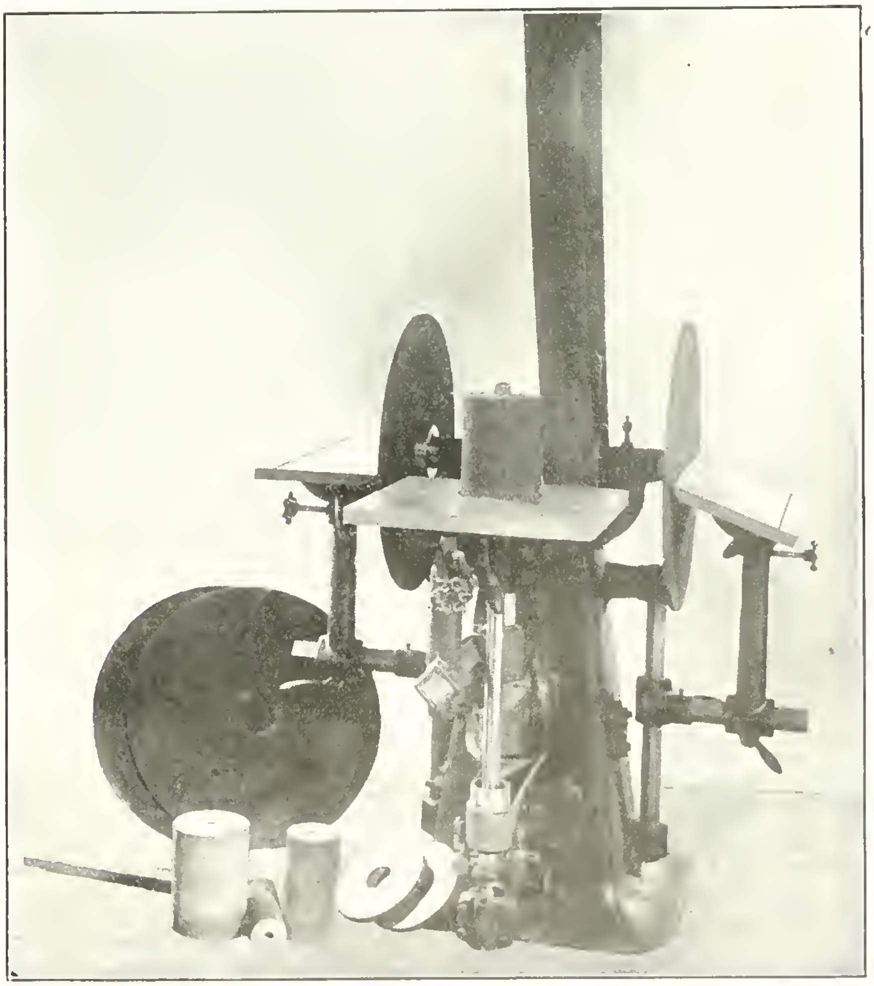
The complete equipment furnished with the new No. 20 combination includes, 30-in. disk wheel, 3 universal work gauges, countershaft, 4 aluminum sanding rolls, a supply of "Netbac" garnet disks and sanding strips, cement, grease, wrenches, etc. The weight of the entire outfit is 3,000 pounds.

THE "DOWNER" GRINDER.

THE Downer Grinder Co., Toronto, Ont., are putting on the market a new wood grinder which is specially designed to meet the requirements of the patternmaker and woodworker. The machine, it is claimed, is very flexible as regards the variety of work that can be done, at the same time effecting a great saving of time and labor. Any regular or irregular shape work can be readily ground to exact dimensions and form, dispensing in many cases with the necessity of using a band saw.

As will be seen from the accompanying illustration, the grinder has two horizontal disks and a vertical drum. The disks are made of steel, 24 in. diameter, each having two abrasive surfaces, while the vertical spindle will take drums from $1\frac{1}{2}$ in. to 7 in. diameter. The drums can be removed from the vertical spindle and attached to the main arbor, thus forming a horizontal drum.

This attachment, in conjunction with the adjustable table, performs the same service as a planer. All the tables are adjustable and can be tilted to any desired angle; they can be lowered to the extreme edge of disk or removed, leaving the disk entirely exposed when handling large pieces of wood.



THE DOWNER WOODWORKERS' GRINDER

The grinder illustrated occupies a floor space of 42 x 48 in. and weighs 1,200 lbs. Patents are, we understand, being applied for in Canada, Great Britain, and the United States.

Steam Boilers in Central Stations.—In a paper on "Steam Boiler Operation in Central Stations," Mr. J. W. Jackson says:—"The selection of fire-bricks is one that naturally requires very careful attention. The particular make of fire-brick to be used depends not altogether upon the quality of the brick, but to a great extent upon its character. Some fire-bricks with great reputations run to slag very quickly indeed, while, again, other fire-bricks practically unknown do excellent work with the same coal. There is, of course, no great wonder at this when it is remembered that the sulphur content of coal varies very considerably, while, again, some coals contain a fairly considerable amount of impurity, such as fire-clay. This fluxes some makes of bricks very badly, and, on examining the furnace after quite a short run, it will be found that the molten fire-brick or slag has run down the underside of the furnace arch, cutting quite deeply into the fire-brick and practically making rivers running down the side walls and on to the grates, with the result that the fires quickly get into a very bad condition, and need to be cleaned by means of a long slice as frequently as once per hour."

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A weekly newspaper devoted to the machinery and manufacturing interests, with special reference to machine tool improvement and development, machine shop methods, devices and systems relative to efficiency and economy of production.

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Vol. XI. MAY 28, 1914 No. 22

PRINCIPAL CONTENTS.

THE BUSINESS OUTLOOK.

IT is quite evident that no concerted attempt to bring business conditions back to normal will be made until this year's crop is assured as to quantity and quality. It is impossible to shut one's eyes to the fact that control of our financial resources is the monopoly of a few, so that when they say "thumbs up," we all follow, and do likewise when it is "thumbs down."

The period of adjustment, so aptly termed and so much and so brazenly paraded is nothing short of a reflection on the capacity of those who dictate our financial affairs, in that they allow things to run riot sufficiently long to make it worth while, and then turn about to the other extreme and play that as long as it yields a return. There are devious ways of working for the upbuilding of Canada industrially, but those most in evidence are simply appendages to personal profit.

THE PLACING OF RESPONSIBILITY.

THE success of a great many notable business men, as one notable himself has said, is due to their ability to secure the highest possible quality of service from others. John Wanamaker accomplished this by seeking and securing the highest type of help from other successful institutions. R. T. Crane, on the other hand, did just as well by devoting particular attention to the training of his own men.

In any case, the ability to specifically place the responsibility for the perfection or non-perfection of a piece of work upon some particular man rather than upon onself is a most important step towards the desired end. While the application of this principle in the stern, Napoleonic fashion of some of our industrial barons is not to be advocated, yet the man with many jobs to look after and numbers of men to keep busy and contented will find it a great worry absorber.

Again, it will also declare when the foreman himself is at fault and enable him to place before his subordinates an occasional example of chivalrous acknowledgment. The accurate placing of cause before an error occurs requires but to call the man's attention to the results afterwards, avoiding the intermediate steps of questioning, accusing and argument and assisting greatly the establishment of harmony and good-will.

VERSATILITY IN MANUFACTURING METHODS.

WHEREVER we go we find narrowness of thought and cramped facilities the cause of much friction and trouble. The foreman alone knows what it is to be beset by the inaptitude of green hands on the one hand and the lack of broad-mindedness of very old employees on the other.

One of the most difficult things the conscientious man in charge must face is the forcing of corrective measures involving personal conduct and work. The natural desire to avoid the wrong-doing man in the hope that he will either kill or cure himself is responsible for much vexation that the well-meaning foreman does not deserve. The sooner and more fearlessly an act of wilful insubordination or disrespect can be tactfully corrected the better for all concerned. If the act can be prevented or nipped in the bud the results will be better still.

By far the most effective means of reducing trouble of this kind is to train a number of men and to provide several different methods for doing every job in the plant. The most unreasonable man is he who is encouraged to believe himself the only man that can do a certain piece of work. The competition of several men on the same work will promote a useful rivalry and a mutual regard and respect. The preparedness to do a job either on the shaper or grinder or on the lathe or drill press will wonderfully facilitate the regulation of men and quantities as well as the determination of the best methods of doing things.

An adoption of both these maxims as working principles, coupled with tact and fearlessness, will do much to eliminate worry and discourage antagonism as well as to encourage a healthy rivalry and general good-will.

INDUSTRIAL NOTABILITIES--No. 36

HON. SIR LYMAN MELVIN JONES was born in County York, Ont., September 21, 1843, son of Norman and Therese Jane (Patterson) Jones.

As a young man he entered the employ of A. Harris & Co., agricultural implement manufacturers, Brantford, Ont., and was admitted a partner of the firm in 1878, becoming Western manager with headquarters at Winnipeg in 1879, and later being made general manager of the company.

Sir Lyman has taken an active part in municipal, political, and business affairs, hence we find him Alderman and Chairman Finance Committee, Winnipeg in 1886; Mayor of Winnipeg during 1887-1888; Vice-President Board of Trade, Winnipeg, 1887-1888; Member Manitoba Legislature, 1888-1889; and Provincial Treasurer, Greenaway Administration during the same period.

HON. SIR LYMAN MELVIN JONES.

On the formation of the Massey-Harris Co., he was appointed general manager of the consolidated companies, and in 1891 he moved to Toronto. Since 1902 he has been president and general manager.

In 1901, Sir Lyman was called to the Senate of Canada, while the honor of knighthood was conferred on him in 1911.

He has been a member of the Toronto Board of Trade since 1893, is a member of the Toronto, National, Royal Canadian Yacht, Victoria, Toronto Cricket, Ontario Jockey, and Rideau (Ottawa) Clubs, and is rated a millionaire.

He married Louise Irwin, daughter of Thomas Irwin, Tecumseh, Ont., in July, 1872, and there is one daughter.

Sir Lyman is a Director, the Canadian Bank of Commerce; Director, The Verity Plow Co., Brantford, Ont.; Director, Blackstone Mutual Fire Insurance Co.; and Merchants Mutual Fire Insurance Co., Providence, R.I.; President, Bain Wagon Co., Woodstock, Ont.; and President, Johnston Harvester Co., Batavia, N.Y.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	$13 65	
Lake Superior, charcoal, Chicago	16 00	
Ferro Nickel pig iron (Soo)	25 00	
	Montreal.	**Toronto.**
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 75	18 10
Victoria, No. 2X.......	18 50	17 85
Victoria, No. 2 Plain ..	18 25	17 60

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b.. Toronto........	2.00
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh............	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh..........	1.15
Beams and angles, Pittsburgh....	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base..	$2 15
Cut nails $2 60	2 65
Miscellaneous wire nails...	75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.	2 85

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb. off
Nuts, Hexagon, all sizes..	4½ per lb. off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright ......85, 10, 7½, 10, 10 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off	
Wood screws, flathead, Bronze ....70, 10, 7½, 10 p.c. off	

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 75	$15 75
Electrolytic copper	15 50	15 50
Casting copper	15 25	15 45
Spelter	5 25	5 25
Tin	35 00	35 00
Lead	4 85	5 25
Antimony	8 50	8 50
Aluminum	20 00	19 00

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double...	60%
Standard	60 & 10%
Cut leather lacing, No. 1	

BELTING RUBBER.

Standard	60%
Best grades	30%

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright....	3.90	4.00
Apollo brand, $10\frac{3}{4}$ oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G. ...	4 30	4 65
Fleur-de-Lis, 28 B.W.G. ...	4 10	4 45
Gorbal's Best, No. 28......	4 40	4 65
Viking metal, No. 28......	4.00	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal. ..	0.24
Benzine, per gal	0.22
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled......	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough. Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., May 23, 1914.—This week has brought very little change in local conditions, although some firms report a slight improvement in machinery inquiries. The C.P.R. have placed a few small orders for single machines during the past week, but apart from this there is nothing special to report.

A dispatch to hand contains the information that the committee of first and second bondholders of the Canada Iron Corporation have now completed the scheme of the proposed reconstruction, which will be submitted at a meeting to be held in London on July 2. The new company, which it is proposed to form, will create £200,000 of six per cent. debenture stock, of which not less than £120,000 nor more than £140,000 will be subscribed at 95 per cent. to provide the necessary cash for a working capital. The remainder will be held in reserve. There will also be created £800,000 of six per cent. debenture stock. The existing first bondholders will be allotted an amount equivalent to the par value of their existing bonds. Non-cumulative six per cent. preference shares and common shares will also be created.

Navigation on the St. Lawrence has been greatly delayed during the past week by the thick haze of smoke, resulting from the numerous bush fires. The financial loss has been considerable, many vessels being as much as ten hours overdue. The Hall Engineering Works are busy effecting repairs to the Manchester Inventor, which suffered damage to her bow and broke off two blades of her propeller in the heavy ice encountered in the Gulf. The repairs necessitate a considerable amount of work, as she was leaking rather badly; but it is hoped to have the ship ready to sail again on her schedule date.

The building trade is fairly active, and a commencement has been made with a new ten-story office building to be erected by the Bank of Toronto. A large number of residential houses are also planned for this summer, and in most cases work is well under way. The Good Roads Congress closes to-night, and has been a pronounced success, large numbers having visited the Arena from day to day.

The steel market shows no improvement. Inquiries are light, the locomotive and car works still working with much reduced staffs, and with little prospect for any immediate improvement.

Metals.

The tone of the metal market is perhaps slightly improved, and a few inquiries are now being received. Casting copper is up $\frac{1}{4}$ cent. per pound, lake and electrolytic remaining firm at their former prices. Tin continues to fall. A further decrease of 1 cent per pound has been recorded this week. The demand for pig iron continues very dull, though in view of the small stocks which the consumers have on hand, it would seem probable that the demand must improve in the immediate future. Most foundries have now on hand not more than would last them normally about two weeks, but even so, they seem reluctant to commit themselves to any large contract, and continue to buy in a hand-to-mouth manner. At present prices furnaces are not making any money, and it is understood that the only Canadian furnace now in blast is about to close down for a short period until prices improve.

Toronto, Ont., May 26, 1914.—Trade conditions do not show any material improvement this week. A want of confidence still seems to prevail in business circles. It looks as if this period of depression will continue for some time. The outlook is perhaps not as bad as present conditions would indicate, although as the season advances it becomes more evident that there will not be much improvement industrially, at any rate, until a good crop is assured. The crop reports are favorable, generally speaking, and conditions in this respect are normal. It is to be hoped that the crop returns will be such that they will, in a large part, make up for the falling off in manufacturing and so place the country in a favorable position for next year. In the meantime a quiet period must be expected which will in some respects be beneficial, if only to serve as a check to speculative enterprises.

It is probable that the transportation facilities may be considerably improved in the suburban districts of Toronto. It has been suggested that the city should operate a service of motor buses in certain districts not actually served by the street railway. The Board of Control will ask for an opinion as to the legality of a by-law being submitted to the ratepayers for the raising of $250,000 for the purpose of buying the necessary equipment.

In a general way iron and steel market conditions show no material change over last week, although there appears to be a feeling that business in these products will improve at no distant date. Prices are being maintained and it is probable that the bottom has been reached. The demand for structural material is quiet, specifications being light. It is reported that a scheme for the proposed reconstruction of the Canada Iron Corporation will be submitted to the bondholders at a meeting to be held early in July. A satisfactory solution to this company's difficulties will be welcomed generally.

The pig iron market is dull and the demand has not improved, consumers only buying to cover immediate requirements. Additional tonnages of Nova

Scotia iron have been delivered at Bridgeport, Conn., and Philadelphia, Pa., on contracts closed with the Dominion Steel Corporation.

Machine tool dealers report little business, and that only in single machines, no good-sized specifications have been received for some time. A number of enquiries are apparently being held up pending a return of better trade conditions. In machine shop supplies a steady business is being done, although consumers are still sending in light orders.

The metal markets are quiet and in much the same condition as last week. Prices keep about the same level, although the market is dull and there is little business passing.

St. John, N.B. May 23, 1914.—Work is being rushed on the Valley Railroad from the Barony to Andover, N.B., by the contractors, Kennedy & McDonald, who have about 900 men employed. A new steam shovel has recently been added to their equipment at a cost of $13,000, and three trains are at present hauling away material from it.

This week it is planned to start work on the section from Woodstock to the Barony, in ballasting. Two shovel outfits will be used. By August 30, this work will be completed, it is expected.

The Dominion Bridge Co. will finish work soon on the superstructure for the new bridge at Pokiok, N.B. On the comperature was below zero, and even as low & McDonald will resume track laying from that place to the Barony, where they will tie up with the Hibbard Co., and the whole line to Fredericton will be completed and ready for the Intercolonial Railway operation by August 30.

The line from Woodstock to Centreville, N.B., is about finished, and freight trains are now running over this branch road. The Dominion Government this week announced its intention of erecting three new bridges for the lower part of the new Valley Railway at a cost of about $3,000,000, and it is hoped to have a start made on the work this summer. This new road will have a remarkable influence upon the industrial life of New Brunswick and will open up a great stretch of undeveloped territory besides offering railway facilities to many inland towns.

Plans have been drawn for a new agricultural building at Sussex, N.B., at a cost of $40,000. A new railway depot is also being erected at that place, and there are signs of much building and industrial activity during the present year.

No successful method has yet been found for depositing silver in any solution which does not contain cyanide.

Miscellaneous

Engineers' Adjustable Wrench.—The Billings & Spencer Co., Hartford, Conn., have brought out an engineers' adjustable wrench, which is capable of being used wherever there is need for a solid end wrench, and in addition possesses the advantage of being adjustable for various sizes of nuts. The motion of the movable jaw is controlled by a worm meshing with a rack formed in the back of the jaw. The wrench is drop forged throughout and is made in four sizes, for handling $\frac{5}{8}$, 15-16, $1\frac{1}{8}$ and 1 5-16-in nuts. The length of the smallest wrench is 6 in. and the largest 12 in.

Electric Motor Operation and Maintenance.—In a paper by Mr. E. F. Butler on "The Operation and Maintenance of Electric Motors," recently read before the Junior Institution of Engineers, the author pointed out that to get the best results the upkeep of the plant should be considered before it was installed, and the points to which special attention should be paid were suitability to the requirements, accessibility, the use of the smallest possible number of different sizes of motors, and standardization in every possible way, so that the number of spare parts and replacements which had to be kept in stock might be reduced to the utmost. With regard to the choice of motors and their control gear, the author enumerated the constructional features which should be found in a good machine, and gave a series of practical hints for remedying faults in existing installations.

Cedars Rapids Mfg. and Power Co.—The substantial progress accomplished in the ten-million-dollar water-power development at Cedars Rapids, near Montreal, was revealed to an interested party which made a visit of inspection to the new plant on Saturday, May 16, as guests of the directors of the Cedars Rapids Manufacturing and Power Co. In respect both to speed of construction and to cost, the undertaking gives fair promise to prove a record-breaker among local enterprises of like magnitude by justifying the advance estimates of the company. In important directions the work is now three-quarters completed, the company being well within the carefully-drawn-up schedule, which was mapped out some two years ago. Barring some unforeseen and very improbable setback through the summer, the plant will be developing by November 1, the 100,000-horse-power planned as the initial installation.

Combating Interference with Construction Work.—By keeping currents of several hundred amperes flowing continuously through water pipes which otherwise would have been in danger of freezing, it was possible to continue construction work on the hydro-electric development of the Cedar Rapids Co., near Montreal, without interruption during even the coldest days of the past winter. The 1-in. pipes thus protected supplied water for the steam shovels and were laid above ground, as continuous shifting prevented them from being buried. Current for the pipe circuits was obtained from a bank of transformers stepping down from 2300 to 220 and 110 volts. The pipe connections consisted of copper wires wound around the ends of the pipes and buried several feet in the earth to prevent the pipes from freezing below the connection. When the tempIetion of this bridge at Pokiok, Kennedy as —27 deg. Fah., it was found that 40 kilowatts at 220 volts would keep 1,500 ft. of 1-in. pipe from freezing, even with water standing in it. A 1,000-ft. pipe required 20 kilowatts at 110 volts.

NOT EFFICIENT IN ALL DEPARTMENTS.

THE Ford Motor Co., which has so efficient an organization, is doing a lot of unnecessary work in connection with its outgoing letters. The Ford outgoing mail is unusually large and a great deal of time, labor and money is being saved through the use of a No. 6 outlook envelope, but the name and address upon the envelope, for some reason, are placed in a position that makes it necessary for the mail clerks to go through five operations to fold and insert the letterhead, and the four folds upon the letter does not give their correspondence a very neat appearance when removed from an envelope.

A great many concerns who take pride in the appearance of their correspondence are adopting the No. 9 envelope in preference to the No. 6, not alone for the purpose of saving time in the putting up of the mail, but on account of the appearance of their correspondence when it reaches their customers, as there are but two motions in folding a letterhead for a No. 9 envelope, against four motions for the No. 6 or $6\frac{1}{2}$, or five motions for the smaller size envelope when the address is not placed in the correct position.

The Ford Company is apparently no different from the majority of concerns, who have been making thorough studies as they apply to the manufacturer, but they have not carried the same studies into the administrative end of the business. With the splendid work that is being done at the Ford plant, it will only be a question of a short time before the discovery will be made that they are doing double the work necessary in putting up their daily mail.—Efficiency Magazine.

TRADE AND COMMERCE RECORD

Dealing With the Steps Being Taken and Progress Made by Industrial Canada To Achieve and Maintain a Dominant Place in the Markets of the World

RETRENCHMENT AND ECONOMY.

In a recent interview regarding immediate business prospects, Sir Frederick Williams Taylor, manager of the Bank of Montreal, said the Canadian people must learn the lesson of retrenchment and economy.

"Extravagance has been rampant in Canada for the last few years," he declared. "Business men have accepted our amazing prosperity as fact and have not thought it worth while to consider whence it came. They have accepted all these good things as though they were rained down from heaven above, but it is time to realize that our recent industrial and business expansion has been brought about by an inflow of British capital. That fructifying stream has been the main cause of our tremendous development in recent years, and Canada should consider whether it is not wise to take measures to prevent that stream from drying up.

Temporary Prosperity.

"Mere lavish expenditure of capital will bring temporary prosperity even if that capital is flung about in the Sahara desert; but such prosperity is without any element of enduring success. True prosperity must be built upon the sure foundation of hard work and productive enterprise. Gambling and speculating in real estate and other attractive ventures must inevitably bring reaction and depression.

"It is almost incredible, and yet a fact, that the cost of living in Canada is the highest in the world, and yet we have millions of acres of virgin soil, hundreds of millions of wealth in natural resources, and a virile, vigorous and aggressive population.

Elements of Success.

"Canada has all the elements necessary to command success. She has people, resources, enterprise and access to sources of capital. Let it not be forgotten that our prosperity depends upon a proper use of these materials, and further than that, let it not be overlooked that the stream of vitalizing capital from England is essential to our growth and industrial and financial progress.

"Canadians should set their faces against wildcat propositions, and seriously consider whence their prosperity has come and how it can be furthered and preserved."

CANADIAN ALLIS-CHALMERS, LTD., STRATFORD PLANT.

The Stratford Mill Building Co., Ltd., Stratford, Ont., was taken over last September by the Canadian Allis-Chalmers, Ltd., of Toronto. The new proprietors at once proceeded to make considerable extensions, including a large addition to the main building and the erection of a dry kiln, etc. The plant will be equipped with modern machinery for making a full line of transmission, elevator and flour mill machinery.

The site consists of about seven acres on the corner of Erie and Gore Streets, on the main line of the Grand Trunk R. R. in the city of Stratford. A switch from the main line runs into the yards, giving good facilities for receiving and shipping freight. The main building is in the form of an L, three stories high, 320 feet long by 50 feet wide. The corner on each floor is used for offices. The superintendent's office is on the ground floor, the main business offices on the second floor, and the draughting office on the third floor.

The main floor is occupied by the machine and erecting shops, and iron-working departments, while on the second and third floors are the wood-working, pattern and tinsmith departments, storerooms, etc. A freight elevator connects the various floors, which are heated by steam, by the Webster vacuum system, and are artificially lighted by electricity. The large windows give an abundance of natural light, and the shops are equipped with every modern convenience, the men thus working under the very best possible conditions.

On the east side of the plant, adjoining the main building, to form another L, is a wing 250 feet long by 50 feet wide, in which are located the steam plant, blacksmith shop, foundry and planing mill. South of the main building on the west side is the shipping de-

STRATFORD ONT. PLANT OF CANADIAN ALLIS-CHALMERS, LTD.

partment, and south of this again are the lumber sheds. In the centre of the group of buildings are the dry kiln, pattern storage and general storage sheds.

Canadian Allis-Chalmers, Limited, have secured from the Allis-Chalmers Mfg. Co., of Milwaukee, Wis., the exclusive right for the Dominion of Canada to sell and manufacture the entire line of Allis-Chalmers flour mill machinery, elevator equipment, transmission and other machines manufactured by that company, and the entire line will be built in the Stratford shops from Allis drawings and patterns.

LAND UNDER CULTIVATION IN CANADA.

THE potential agricultural resources of Canada are indicated by the fact that not more than 2.6 per cent. of the total land area of the nine provinces is now under cultivation. This is one of the interesting statements in a bulletin just issued by the Census and Statistics Branch of the Department of Trade and Commerce.

The total land area of the nine provinces is placed at 1,401,316,413 acres. The area of farm land occupied in 1911, according to the census figures, was 109,777,085 acres, or 7.18 per cent. of the total. It is estimated that within the boundaries of the nine provinces as at present constituted, there is a total cultivable area of 440,951,000 acres. This, it will be noted, is only 31 per cent. of the total land area, and takes no account of forest and swamp lands which may ultimately be tilled, nor of northern areas, of which the agricultural possibilities are at present unknown, because unexplored and unsurveyed.

The total area under cultivation is given as 36,000,000 acres, of which field crops represent 35,375,000 acres, and fruit and vegetable crops 625,000 acres. Only about 33 per cent. of the area now occupied as farm land is at present under cultivation, while, as noted above, only 2.6 per cent, of the total land area is utilized for agricultural purposes.

In Prince Edward Island, 86.01 per cent. of the total land area is occupied as farm land, while 90 per cent. is estimated as being possible of cultivation.

In Nova Scotia, 38.83 per cent. is occupied as farm land, with 60 per cent. of the total land area possible of cultivation.

In New Brunswick, 25.36 per cent. of the land area is occupied, with 60 per cent. cultivable.

In Quebec, 3.52 per cent. is occupied, with 10 per cent. cultivable.

In Ontario, 9.37 per cent. is occupied, with 25 per cent. cultivable.

In Manitoba, 8.33 per cent. is occupied, with 50 per cent. cultivable.

In Saskatchewan, 18.39 per cent. is occupied, with 60 per cent. cultivable.

In Alberta, 10.96 per cent. is occupied, with 65 per cent. cultivable.

In British Columbia, only 1.12 per cent. is occupied, with 20 per cent. cultivable.

TRADE WITH GREAT BRITAIN.

THE following are the official trade figures between Great Britain and Canada in the undermentioned articles during April:—

From Canada.	1914.	1913.
Wheat	£388,132	£348,066
Wheatmeal and flour	146,847	203,079
Barley	19,965	50,944
Oats	4,418	7,498
Bacon	71,225	68,583
Hams	14,666	25,446
Cheese	6,872	53,731
Canned salmon	132,510	98,926
To Canada.	**1914.**	**1913.**
Spirits	75,626	89,676
Wool	12,464	9,700
Pig iron	4,483	7,105
Wrought bars	3,152	9,121
New rails	845	1,871
Galvanized sheets	55,361	70,657
Tinned plates	6,796	11,804
Steel bars, etc	16,247	47,959
Pig lead	5214	12,499

HYDRO PLANS BIG PROVINCIAL DEPOT.

AFTER investigating some fifty different sites, the Hydro-electric Power Commission have purchased a lot on the west side of University Avenue, Toronto, for the new central hydro offices. The deal involves an investment of $65,000 in the property, which is situated near the corner of University Avenue and Orde street, and has a frontage of 100 feet on the Avenue and a depth of 145 feet.

For about two years the question of a central hydro building has been on the tapis, and the selection of the property will clear the way for the Commission to go ahead with its plans. There is a provision of $100,000 in this year's estimates for the building, but the completed structure will probably cost in the neighborhood of $300,000.

The idea of the Commission is to establish extensive laboratories and testing shops, and carry on a central purchasing bureau, with the view of buying supplies in large quantities and turn them over to the municipalities at cost. The testing of new equipment will be another important branch, as well as designing new equipment as the need arises.

There is a proposal to make this building part of the hydro ssytem, and levy an assessment on all the municipalities for its construction and maintenance.

BRITISH TRADE IN CANADA.

THE Canadian Trade Commissioner, C. Hamilton Wickes, addressed the London Chamber of Commerce on May 19, his subject being "British Trade in Canada." Mr. Wickes gave an important analysis of the present position, and showed that of the British trade with the Dominion, valued at 136 millions, the amount on which preference was given amounted to 93 millions. Of 76 millions of competitive trade, 63.5 per cent. was given preference. Were Great Britain to compete on level terms with the manufacturers of other countries she could secure only 14.7 per cent. of the trade.

He had come to the conclusion that if Canada had not granted British trade preference that trade would have been practically nil. Of this 14.7 per cent. a great deal consisted of specialties, such as whiskey and beer, in which commodities there was practically no competition. If the specialties were eliminated, and they were to compete on level terms, they would hardly get any trade at all. The United Kingdom's share of competitive trade was 33½ per cent. It was not a bad proportion, but it was nothing like what it should be, having regard to the excellence of the manufactures and goods which British trades could supply.

The lecturer urged the representation of British firms by agents in the Dominion, adding that until the trading community took a practical interest in trade commissioners, the organization which the Board of Trade had provided would never be as useful as it ought to be.

U. S. Steel Conditions.—Steel market conditions have shown but small change, and while there is still talk of the expected improvement in demand in the near future, nothing of this has been witnessed yet. The railroads are starting their inquiries for new equipment where it will be needed to move the crops, but unless there is a decided improvement in other lines of activity, even the huge crops will not necessitate much additional purchase of cars and locomotives because of the unprecedented total of idle cars. The prospects for unfilled tonnages this month are about the same as last, with a large decrease in view unless buying picks up materially. The rate of steel production for the whole country is placed at around 60 per cent. of full capacity.

Safety Provisions Relative to Transmission Machinery--IV.

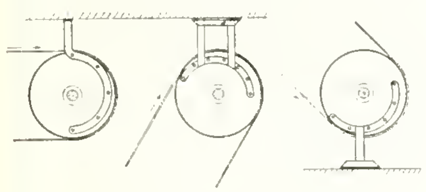
By W. Sydney Smith

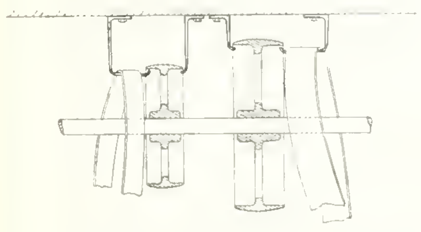
An official report by the Inspector for Dangerous Trades in England, regarding fencing and safety precautions for transmission machinery, has been issued. It explains the structural and administrative safeguards with regard to the several parts of transmission machinery which experience shows to be needed for the protection of persons employed.

THE introductory portion of the present article is a continuation of the **Belt-Perch feature**, and starts off by stating that the design of the bracket (Fig. 18, May 14 issue) can easily be adapted to suit different positions and directions of the driving belts (Fig. 19).

If a pulley be situated close to a bearing, or if two pulleys are close together, modified perches (Figs. 20 and 21) should be fixed to prevent the belt falling between pulley and bearing or between the pulleys,—a frequent cause of accidents and damage to mill-gearing and machinery.

Some form of belt-perch should be used in preference to tying up a belt to the ceiling above the shafting, an operation which often has placed the worker in a position near unfenced shafting, and in many instances has led to fatalities and serious injuries. Whenever any belt repairs are necessary while the shafting is in motion, the belt should never be allowed to come in contact with the shaft, but should rest either on the sleeve fencing the shaft, or on a belt-perch. Portable perches consisting of an inverted trough fixed to the end of a belt-pole are sometimes used, but fixed perches are more satisfactory whenever these are practicable.





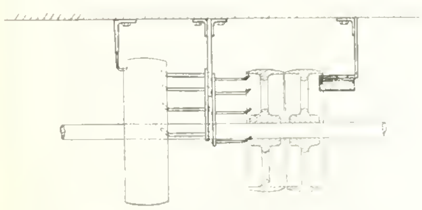


FIG. 19. PERCHES FOR DIFFERENT BELT POSITIONS.
FIG. 20. SIMPLE BELT PERCHES.
FIG. 21. TYPES OF BELT PERCHES.

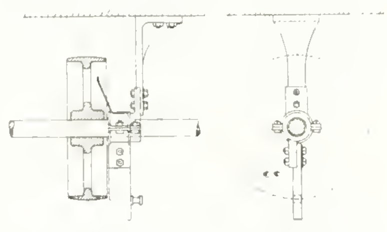
Belt Shippers.

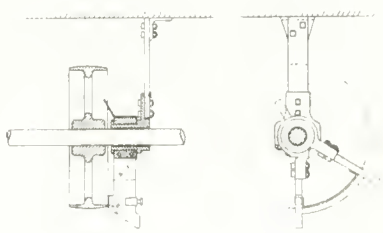
A number of appliances, both portable and fixed, have been designed for replacing belts on pulleys from the floor level. For belts not exceeding three inches wide, an ordinary belt-pole may be used, this being a strong, light pole about 1½ inches diameter, carrying at its upper end a wrought-iron pin at right angles to the axis of the pole. The length of the pole should not be less than the height of the shafting above the floor level, there being risk of accident with a short pole as the lower end is liable to be driven forcibly towards the workman. A rigid belt-pole is unsuitable in many cases, and its use may be considerably limited by position, size, length, tension, or direction of the belts, or by obstructions such as pillars, beams and walls. Various types of jointed and flexible belt-poles have been devised to overcome these difficulties; a flexible pole being probably safer to handle than one of the rigid type. When the belts are too heavy or the shafting too high to allow the use of a belt-pole, mechanical belt-shippers enable the belt to be replaced on the driving pulleys from the floor level with perfect safety, without stopping or slowing the transmission machinery.

The earliest type was invented by M. Boudoin, of St. Sauveur-Luxeuil, in 1871, and is said to be in general use throughout the factories in Alsace. This (Fig. 22) consists of an arm or board with beveled edge bolted to a socket which is free to rotate on a fixed sleeve encircling the driving shaft. This sleeve is attached by a bracket to some convenient support adjacent to the pulley. Both socket and sleeve are made in halves screwed together. The fit between sleeve and socket may be adjusted by tightening or slackening the socket screws. The driving shaft rotates freely within the sleeve. The appliance thus forms a belt-perch upon which the belt rests when thrown off the driving pulley, and each pulley must be fitted with one of these appliances. To replace a belt, the wooden arm and socket are turned through an arc of a circle by means of a pole fitted with a hook which engages a small knob near the lower end of the arm; the beveled edge of the arm picks up the belt, allows it to slide on the pulley at the point of intake, and prevents it slipping off the pulley as it travels round the rim.

The type of belt-shipper adopted by the Italian Association for Prevention of Industrial Accidents closely resembles the above, but the lower half of the socket is provided wth two arms inclined at an angle of 60 degs. towards each other and connected at the beveled extremities by a metal band bent to the same curvature as the pulley rim. (Fig. 23.)

There is also a portable Boudoin belt-shipper which may be used for shafts and pulleys varying somewhat in diameter, as shown in Fig. 24. The apparatus is placed adjacent to the pulley and held in position while the belt is replaced in the usual manner by rotating the arms with a hook attached to a pole.





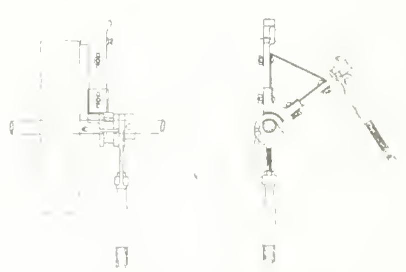


FIG. 22. BELT SHIPPER (BOUDOIN TYPE).
FIG. 23. BELT SHIPPER (ITALIAN TYPE).
FIG. 24. PORTABLE BOUDOIN BELT SHIPPER

The Brancher belt-shipper (Fig. 25), is similar to that of Boudoin, but the supporting bracket and sleeve are omitted; the socket carrying the wooden arm is suspended on the line close to

the pulley, and lateral movement is prevented by a pair of collars screwed to the shaft by counter-sunk screws. The Brancher apparatus and other types may be actuated by means of cords or hand-chains instead of a pole if a light pulley with a v-shaped rim is attached to the socket carrying the belt-shipping arm.

A number of other types have been devised by Continental inventors, and these consist of various arrangements of metal arms adjoining the pulley, and form a belt-perch which carries the unshipped belts. The arms are generally rotated by means of hand chains or cords. An English type of belt-shipper is shown in Fig. 26.

Immediate Stoppage of Transmission Machinery.

Provision should be made in all factories for bringing the shafting quickly to rest in case of breakdown or accidents to workers from transmission machinery. In old installations, electric bells are often considered sufficient for signaling, but these are generally inadequate in case of mishap or accident. Where steam engines are used, more efficient devices are those whereby the engine stop-valve can be directly actuated from any floor or room in a factory, by means of electric push-buttons fixed in a convenient position.

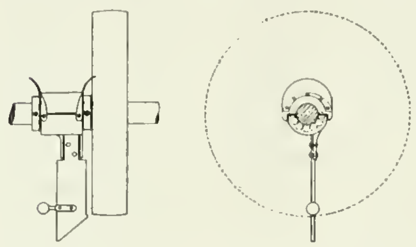
With electric motors for driving the main shafting, it is comparatively easy to arrange in convenient positions, push-buttons to actuate the mainswitch and stop the motor. A powerful electro-magnetic block brake may also be fitted on the line shaft to bring the transmission machinery quickly to rest. If mechanical appliances such as clutches be used, the means for disengaging the transmission machinery should be within convenient reach of the workers.

Oiling and Cleaning.

Such necessary work as oiling and cleaning should be done only by trained and authorized persons; and the oiling of shafting only during stoppage of the transmission machinery, or (if this is not possible owing to special circumstances or the requirements of the manufacturing process) during slow running of the line shafts, unless the transmission machinery is so fenced as to prevent accidental contact with moving parts. Oil cups or lubricators should be fitted on all shaft bearings unless these are of a self-lubricating type. In self-lubricating bearings, the supply of oil or grease will last for weeks or months with little attention, and hence the risk of accident to engineers and greasers is reduced to a minimum.

Lubrication of loose pulleys is not always easy, and if a loose pulley seizes a shaft from want of oil, the machinery may unexpectedly be set in motion and accidents result. The loose pulley is sometimes made slightly less in diameter than the fast pulley in order to lessen the belt tension. Needle lubricators and lubricators of the Stauffer type, or those fitted with a piston and filled with solid grease, are sometimes used. The pulley may ride on a recessed sleeve, secured to the shaft, and be filled with solid lubricant which can reach the inner revolving surface of the pulley boss through holes in the sleeve.

Cleaning and polishing of shafting in motion should never be done with cotton waste, rags or emery cloth held in the hand. Proper appliances should be used, such as long-handled brushes, hooks wrapped round with cord or special clamps with the jaws covered with leather or emery cloth. These can generally be manipulated from the floor level. Rings of metal or leather which hang loosely on the shaft are to be found in some factories. These travel to and fro along the shaft and effectually clean it. They are largely adopted abroad. Many accidents occur between belts and pulleys in motion to workers engaged in treating belts with various compositions to keep them pliant, or in applying resin to slack belts to make them grip the pulleys better. This is a dangerous practice which should not be allowed, unless the transmission machinery is stopped or moved slowly. With a shaft speed of not more than five revolutions per minute, there should be little danger.



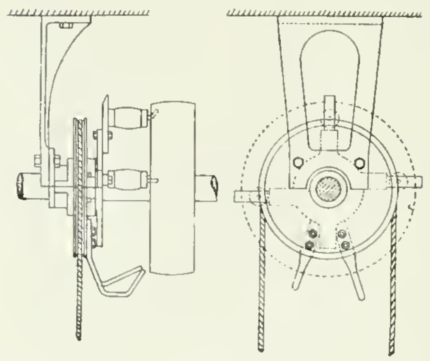


FIG 25. BELT SHIPPER (BRANCHER TYPE).
FIG. 26. SAFETY BELT SHIPPER (COWLEY'S PATENT).

Ladders for Transmission Machinery.

Suitable non-skid devices are necessary for all ladders used in factories, especially in connection with transmission machinery for manipulating belts, oiling bearings, and other work of maintenance. Shafting ladders are generally fitted with hooks at the upper end, large enough to rest on the shafts. The hooks should be bound with cord.

Many appliances have been devised for preventing slipping at the ladder foot. Iron spikes attached to the bottom of the ladder are common, but these are dangerous where persons are accustomed to work with bare feet. Generally speaking, the form and material of the non-skid device should depend on the kind of floor, iron-shod feet being unsuitable for hard floors such as iron plates, flagstones, brick, tiles, or concrete unless the surface be grooved; in such cases, leather or india-rubber is more satisfactory, though unsuitable for greasy floors. Iron spikes, except as above mentioned, or cast-iron swivel shoes, can be used on soft floors such as wood. Where a ladder is required to be reared at different inclinations, swivel feet are the most satisfactory.

NATIONAL SUPPLY AND MACHINERY DEALERS' CONVENTION.

THE programme for the ninth annual convention of the National Supply and Machinery Dealers' Association, which meets in conjunction with the American Supply and Machinery Manufacturers' Association at White Sulphur Springs, W. Va., June 15, 16 and 17, is briefly as follows:

Monday, June 15, 10.30 a.m.—Open session. Annual address of President Charles S. Farquhar, Chandler & Farquhar Co., Boston, Mass.; reports of Secretary-Treasurer Thomas A. Fernley, and of the executive committee.

Monday, 2.30 p.m.—Joint session with the American Supply and Machinery Manufacturers' Association; addresses by well known speakers on topics of national importance to dealers and manufacturers.

Tuesday, June 16, 10 a.m.—Executive session. Report of the treasurer and of the committee on the cost of distributing mill supplies and discussions on cash discounts, association work, direct shipments, stock and cost records, standardization of records and other subjects of interest to machinery dealers.

Wednesday, June 17, 10.30 a.m.—Executive session. New business, election and installation of officers, expressions of preference regarding place of next convention, final adjournment of business sessions.

On Tuesday afternoon there will be no session of either body, which will allow time for private conferences on matters of individual business concern

Modern Transportation--The Electric Truck

By D. Watson

The author of this article not only makes emphatic declaration of the increased efficiency and economy resulting where gasoline and electric motor trucks have superseded horse traction, but unhesitatingly expresses the opinion that the electric vehicle is in turn away ahead of that of its gasoline companion, in many respects for general delivery service.

ONE of the great problems of modern business is the continually increasing costs and decreasing profits. Particularly are these conditions to be met with in manufacturing plants. Wage costs increase, material costs follow, and the plant executive are facing the problem of how to make profits with increasing costs of manufacture, increasing costs of sales and of distribution, and without correspondingly increased returns from higher selling price. The successful business is meeting this condition by increased efficiency.

Among the most inefficient branches of the modern business, is the transportation system. Very little attention is paid to the delivery costs. Few merchants have any accurate idea of what it is costing them to deliver their goods, or how much time and money are wasted by inefficient methods and organization. Evidence of this is found, when attempts are made to gather data as to the cost of horse delivery of merchandise and parcels in our larger cities. Inquiries reveal the fact that costs are not properly separated, and figures are merely estimates, more or less vague. The continual climb in the percentage of cost of carrying on business has compelled attention to this phase of business, as well as others, and executives are beginning to give the matter careful attention, with the natural result that methods of reducing these costs are now looked for.

Motor Truck Transportation.

The rapid and continual rise in the price of horses and of feed, and the loss of time due to congestion of traffic, as our cities grow, has turned attention to motor transport, to motor wagons and trucks. The modern motor truck is no experiment. To think of it as still in the experimental stage, or as simply a pleasure car adapted to commercial needs, is to do it an injustice. The motor truck is the product of the age of modern inventive genius and financial faith; a wage earner like the rest of us, doomed as we are to face the test of character and adaptability. The motor truck is here because the twentieth century needs it.

The motor truck falls naturally into two general classes, distinguished by its power supply, gasoline or electric. Each has its own particular field, and the question of which type to adopt, if any, to replace horse delivery, is purely a question of the class of service it is to supply, and the cost of performing that service. There are other considerations also, that are seldom considered, and yet are daily becoming increasingly important:—viz., those of street cleanliness, traffic congestion and time lost incident to delays caused thereby.

More Economical Than Horse Transport.

Both types of vehicle, gasoline and electric, can show considerable economies over the horse, besides having the very important ability to meet successfully sudden and extraordinary demands for overwork, during rush periods.

On long-haul, non-stop runs of considerable distance, where high speed is required to cover the trip in a given time, the gasoline truck has its advantages. On the other hand it costs more to operate and maintain, and its life is much shorter than the electric of corresponding capacity.

The electric truck has unquestionably demonstrated its superiority in city trucking, transfers and deliveries, and upwards of 80 per cent. of delivery work is just such service. In the larger cities of the United States, in the great haulage centres, the electric predominates, and by far the larger percentage of commercial vehicle fleets are electric. There are many reasons for this, and it would be wise, probably, to look into these with some detail.

Predominance of Electric Trucks.

The electric is more economical than either the horse or the gasoline truck for concentrated city service. It requires no expert chauffeur to operate, while it takes a man born, as the saying is "with a monkey wrench in his hand," and some experiences as an all-round machinist, to keep a gasoline truck on the road. Naturally, men of this calibre want, and get, very high wages. Add to this the high cost of upkeep in tires, repairs, etc., to say nothing of the much higher cost of fuel, and the 20 per cent. annual depreciation, and it makes the gasoline truck an expensive method of transportation.

On the other hand, a couple of days' instruction by a competent demonstrator, will enable the average teamster to successfully operate an electric truck. That is, he will be able to take it around corners without taking the lamp-post with him, back it into alleys and doorways, go down grades at a safe pace, and so on. In a few days he is absolute master of it. In fact, in changing from horses to electric trucks, the regular horse drivers can be utilized, which does much to simplify the problem, as they often possess a valuable knowledge of the delivery routes and methods, and of the firm's customers. Again, most drivers are not only willing, but anxious, to learn to handle the electric. Over two million dollars' worth of electric trucks, in one industry alone, are being driven by ex-teamsters, with great success. Another item of economy in the electric truck is the saving in ground rent, made possible by the smaller housing space required for it. In the present phenomenal increase in real estate values and taxes, this has come to be a matter of great importance. To give just one instance:

In 1906, the Peter Doelger brewery in New York, had over 200 horses, of the best in the country. The horse stables, harness, and wagon rooms, occupied a space 305 feet by 350 feet. These have all been replaced with electric trucks. In addition to the actual saving in delivery of their goods, an immense saving has been made in real estate investment. A fine electric garage has been built 85 feet x 100 feet, with four floors having a capacity of 96 trucks, making a saving of 28 city lots, valued at $560,000. The space saved is now devoted to a new bottling plant and shipping room. Allowance has been made in the garage for future expansion of business, as 52 trucks are doing all the work of the previous horse equipment.

This company found it was costing them 15 cents per barrel for delivery within an eight-mile radius, as against 55 cents per barrel with horses and, with improved methods of handling made possible by the motor truck, it is expected to reduce this to 12½ cents. Their superintendent reports the saving in 1912, due to modern electric delivery equipment, to be $80,000.

Due to its simplicity and fewer parts, the electric truck is much more dependable. There are no reciprocating parts—no cylinder, carburetor, magneto, clutch, transmission, or cooling system troubles, for it has none of these trouble-makers in its system. No damage by frost in winter time, for it has no water circulation to freeze. The entire power plant consists of four items — motor, silent chain, countershaft and roller-chain drive. A look at the chassis of the two systems will reveal this to the most casual glance; three moving parts as against dozens. This item of dependa-

bility, of always being "on the job" when required, of running day after day, without expensive lay-ups for repairs and replacements, is one of the strongest points of the electric. Scores of electric trucks in daily service to-day are from eight to ten years old, and while not so efficient as their more modern brother, are still far too valuable to be scrapped.

DECARBURIZATION IN HARDENING STEEL DIES.

THE following note was contributed to the London meeting of the Iron and Steel Institute, May 7 and 8, by Dr. H. C. Greenwood:

"In some preliminary trials of an electric muffle for hardening steel dies, the steel (containing about 1 per cent. of carbon and 1 per cent. of chromium) was allowed to soak at 820 degrees C. for an unnecessarily long time—namely, about one and a half hours—in order to make quite sure of uniformity of temperature. The working face of the die was protected against scaling by a sheet-iron cover filled with powdered charcoal. On removal from the furnace the cover was knocked off, the face brushed free from charcoal and the block quenched under a spray.

Curiously enough the working face, which had hen in contact with charcoal during the heating, was found to be superficially soft, while all the other parts of the die (which, by the way, had a less sudden cooling) were perfectly hard. The surface could be filed to a depth of about half a millimeter, below which the steel was glass hard. This behaviour was not confied to a single instance, but was observed in all cases where the surface was protected in this way. If the face were left bare the surface was perfectly hard, but somewhat pitted by oxidation. This difficulty was, however, overcome by using some inert powder, such as fine sand, instead of charcoal, to cover the surface, no diminuation of the hardness being effected.

It only remained to seek an explanation of the paradoxical action of the charcoal in softening the surface layer. Some test-slices of the steel were accordingly taken and heated under the same conditions, packed in charcoal, for about one and a half hours, while similar strips, unprotected in any way, were heated alongside. All were quenched together, and, after annealing at 600 degrees, and cleaning with emery, the respective surfaces were planed off (taking a very light cut) and combustions made of the planings. This procedure was repeated, changing round the specimens after machining of 1/8 in. from each surface. The analyses gave the following results in carbon per cent., for experiments I and II respectively:

	I.	II.
Specimens pro. by charc'l ..	0.38	0.59
Specimens unpro. by charc'l.	1.08	0.87

It is clear from these results that a decarburization of the surfaces in contact with carbon had been effected, and this is confirmed by the fact that the soft skin persists in rehardening. Why such an action should take place is, however, not very obvious, and the main reason for publishing this note is to ascertain if any similar effects have been observed by others.

LOW PRESSURE BOILER EXPLOSIONS.

MANY steam users are under the impression that, when boilers or vessels to which steam is admitted for heating and boiling purposes are worked at low pressure, failure cannot produce serious results, though experience often shows this assumption to be untrue. In the early days of steam many terrible boiler explosions occurred, although boilers were then of a primitive type, and pressures used only a few pounds per sq. inch, which is insignificant as compared with modern practice. In the event, however, of the sudden rupture of a large boiler, even when working at low pressure, the amount of energy liberated is capable of doing great damage.

In the May issue of the Vulcan is an illustration taken from the Illustrated London News for December 27th, 1845, showing the havoc wrought by the bursting of a wagon boiler at a cotton mill at Bolton. The boiler was of a type which was incapable of resisting a high pressure, and though the actual working load is not stated in the brief account of the disaster, it seldom exceeded 12 lb. to 15 lb. on the inch. All the same, it sufficed, as the illustration shows, suddenly to convert a large part of a four-storied mill into a heap of ruins and kill ten workpeople, while nine others were more or less seriously injured.

Sir Joseph Wilson Swan, inventor of the original incandescent electric lamp, died on May 27. He was 86 years old, and was born in Sunderland, England. Sir Joseph spent many years of his life in experimenting with electric lamps, and in 1879 succeeded in solving the problem of producing an incandescent light, and thus making possible the general use of electricity for lighting purposes. He was the inventor of many other electrical devices, including a miner's safety lamp and an electric meter. He also made many improvements in accumulators.

MATERIALS OF CONSTRUCTION.

PROFESSOR E. HEYN, Berlin, Germany, in the course of a lecture delivered by him on May 12 before the Institution of Mechanical Engineers, said that it was a well-known fact that the welfare and convenience of modern mankind was, to a very considerable extent, influenced by the achievements of the engineer. People admired his work and were daily confiding life and health to his creations, but only a few were conscious of the fact that engineering work was, to a great amount, dependent on the possibility of manufacturing sound materials fit for the purpose, and of keeping them sound in the course of the manifold processes that these materials required to go through until they were assembled into the admirable engineering structures presenting themselves to the public eye. Few persons were conscious of the enormous amount of thought bestowed on the question of soundness of materials by thousands of men fighting continuous struggles against the numerous hidden dangers involved in the intricacy of structural material, and working strenuously towards its perfection and reliability.

Certain structural members might fail even without being subjected to stresses in service. For instance, it had often been observed that condenser tubes made out of brass cracked simply when stored up in the yard. Some articles made out of this metal, when exposed to atmospheric influences, underwent an alteration to such an extent that they might be crumbled between the fingers. Similar phenomena could be stated in structural members made out of other metals and alloys, when they were manufactured under unfavorable conditions, which lead to serious internal strains.

The author said that he had made a special study of the phenomena connected with internal strains, investigating their causes and devising a method for measuring their amount, and in the course of the lecture he dealt specially with the internal strains produced by cold working of metals (cold drawing, cold rolling, cold hammering, etc.). He showed that, by these operations under unfavorable conditions, internal strains might be set up in structural members which came close to their resisting power, so that even trifling additional strains caused by external forces or other circumstances (scratching of the surface, unequal heating or cooling, slight corrosion by certain agents which were contained in the atmosphere or by certain paints) might lead to unforeseen fracture. He discussed the means for removing or diminishing such dangerous internal strains, and illustrated his lecture by numerous samples taken from the domain of practical engineering.

The Effect of Electrical Engineering on Modern Industry *

By Charles P. Steinmetz **

In Section I. of the accompanying article, energy in chemical and electrical form is discussed and comparisons made, while in Section II. the part that distribution of materials and energy play in our civilization is treated also from the comparative achievement standpoint of chemical and electrical energy.

THE use of electricity in modern civilized life is rapidly increasing: in lighting our homes, factories, streets; in industrial power applications; in domestic service, from the fan motor to the electric bell or the heating and cooking device; in transportation: and while no great inroads have yet been made into the field of the steam locomotive, an entire system of electric railroads has sprung up all over the country, fully comparable in size and power demand with the steam railway system; large new industries have developed in electro-chemistry and electro-metallurgy, supplying us with materials unavailable before—as aluminum—or improving the production of other materials—as in copper refining, etc.

All these applications are uses of energy, and in nearly all electrical energy is replacing some other form of energy used heretofore: chemical energy of fuel, or mechanical energy of steam or gas engines, etc. To understand the reasons which enable electrical energy to compete successfully with other forms of energy, which are longer and more familiarly known, we have to look into its characteristics.

Electrical Energy Characteristics.

Electrical energy can be transported—or, as we usually call it, transmitted—economically over practically any distance. Mechanical energy can be transmitted over a limited distance only, by belt or rope drive, by compressed air, etc.; heat energy may be carried from a central steam heating plant for some hundred feet with moderate efficiency, but there are only two forms of energy which can be transmitted over practically any distance, that is, which in the distance of transmission are limited only by the economical consideration of a source of energy nearer at hand: electrical energy, and the chemical energy of fuel. These two forms of energy are the only competitors whenever energy is required at a place distant from any of Nature's stores.

Thus, when we study a problem in electric power transmission and consider whether it is more economical to transmit power electrically from the water power or the coal mine, or to generate the power by a steam plant at the place of demand, both really are transmission problems; and the question is whether it is more economical to carry energy electrically over the transmission line, or to carry it chemically, as coal by the railroad train or boat, from the source of energy supply to the place of energy demand, where the energy is converted into the form required, as into mechanical energy by the electric motor or by steam boiler and engine or turbine.

Electrical and Chemical Energy Compared.

Electrical energy and chemical energy both share the simplicity and economy of transmission or transportation, but electrical energy is vastly superior in the ease, simplicity, and efficiency of conversion into any other form of energy, while the conversion of the chemical energy of fuel into other forms of energy is difficult, requiring complicated plants and skilled attendants, and is so limited in efficiency as to make the chemical energy of fuel unavailable for all but very restricted uses—heating, and the big, high-power steam plant.

Pressing the button turns on the electric light and thereby starts conversion into radiating energy: with chemical energy as source, either special fuels are required in the candle, kerosene lamp—or a complex gas plant. Closing the switch starts the motor, whether a small fan motor or a 1,000-horse power motor supplying the water system of a city or driving the railroad train. With fuel as the source of energy, the boiler plant, the steam engine, or turbine, with their numerous auxiliaries, and skilled attendants, etc., are necessary, and the efficiency is low except in very large units.

To appreciate the complexity of the conversion of the chemical energy of fuel, compared with the simplicity of electrical energy conversion, imagine the domestic fan motor with coal as the source of energy. We have a small steam engine, with boiler and furnace, attached to the fan, and to start the latter we have to make a coal fire and raise steam to drive the engine. This illustrates how utterly unavailable the chemical energy of fuel is for general energy distribution. General energy distribution, therefore, may justly be said to date from the introduction of electric power.

Equally true is the reverse: the conversion of mechanical or other energy into electrical is simple and economical, while the conversion into chemical energy is not. Hence, one of the two large sources of Nature's energy, the water power, was, before the days of electrical engineering, useless except to a very limited extent, since the location of the water power is rarely such that the energy could be used at its source. The water powers thus have really been made available only by the development of electrical transmission.

Density Concentration of Electrical Energy.

It is a characteristic of electrical energy that it can be concentrated to an energy density higher than any other form of energy, and results can thus be produced by it which no other form of energy can bring about, or do directly by the brute force of energy, as we may say, which formerly had to be brought about in a roundabout way.

Thus iron can be reduced from its ores by the chemical energy of coal in the blast furnace, but aluminium and calcium can not, as their chemical affinity is higher, and require the higher energy concentration available with electric power. Iron reduced in the blast furnace combines with carbon to cast iron, so calcium combines with carbon in the electric furnace to carbide, the starting material of acetylene, and of cyanamid and the modern fertilizer industry. Platinum can just be melted, and quartz softened, in the hottest flames of combustion—the oxy-acetylene flame and the oxy-hydrogen flame; but, in the electric arc, platinum and quartz and every existing substance, even tungsten and carbon, can be melted and distilled or sublimed. Accordingly, mighty industries have grown up and many new materials made available to man, as aluminum, silicon, calcium, chromium, the carbides, cyanamid, acetylene, etc., while others are produced in a cheaper manner, as alkalies, hypochlorites, phosphorus, magnesium, sodium, etc.

Electricity as such is the most useless form of energy: it is not found in Nature in industrially available quantities, and finds no industrial use as electrical energy, but it is always produced from some other form of energy, and converted into some other form of energy: light, mechanical energy, chemical energy, heat, etc. That is, electrical energy is entirely the connecting link,

*From the Journal of the Franklin Institute.
**Chief Consulting Engineers, General Electric Co.

the intermediary, by which energy is brought from the place where it is found to the place where it is used, or changed from the form in which it is found to the form in which it is used.

Thus, on first sight, it appears a roundabout way, when, for instance, in modern electrical ship propulsion an electric generator is placed on the steam turbine, and a motor on the ship propeller, a few feet away, though it is not different from practically every other use of electric energy: a transmission link, superior to any other transmission by the flexibility given by the simplicity and economy of conversion.

Electrical Energy Storage.

The most serious disadvantage of electrical energy is that it can not be stored. It is true there exists the electric storage battery, and it is used to a large extent as a stand-by battery in high-grade electric distribution systems to give absolute reliability of service, or as a battery floating on a railway circuit to equalize fluctuations of power, or in special applications, as electric automobiles. It does not really store electrical energy, but stores energy by conversion of the electrical into chemical energy, and by reconversion, in discharge, of the chemical into electrical energy.

The economic efficiency of the storage battery—using the term in the broad sense, including interest on the plant investment and depreciation—is so low that the storage battery does not come into consideration in the industrial storage of energy—that is, in making the rate of electrical energy consumption independent of that of energy production. We can best realize this by comparing electrical energy with the chemical energy of fuel; the latter can be stored with perfect economy.

Thus, when using fuel as the source of energy—in a steam plant—no serious difficulty is met by the industry even if the fuel supply is interrupted for months, as in the case of a supply by water, through the closing of the navigation by ice. We would simply bring in a sufficient coal supply to last until the navigation opens again in spring; but with electrical energy from a water power we could never dream of storing energy by storage battery to last over the two or three months during which the river runs dry and the water power fails.

Electrical Energy Cost Feature.

This means that electrical energy must be consumed at the rate at which it is produced, and the cost of electrical energy thereby becomes dependent on the rate of the energy used. This is not the case with most other forms of energy, as, for instance, the chemical energy of fuel. The price of a ton of coal, as determined by the cost of supplying it, is the same whether I dump the coal into a furnace all at once, or whether I use it up at a uniform rate in a small stove, lasting for weeks.

If I consume 2,400 cubic feet of gas per day, its cost and thereby its price is the same whether I use the gas at a uniform rate throughout the day, or 100 cubic feet per hour, or whether I use the entire 2,400 cubic feet in one hour and nothing in the remaining twenty-three hours. The gas is produced at whatever rate is most economical, stored in the gas holders, and supplied from there at whatever rate it is required for consumption. If, however, I use 240 kilowatt-hours of electrical energy per day, it makes a very great difference in the cost of supplying this energy whether I use it at a uniform rate of 10 kilowatt-hours per hour, or whether I use the entire 240 kilowatt-hours in one hour and nothing in the remaining twenty-three hours.

In the former case, 10 kilowatts of generating machinery are necessary in the steam or hydraulic station producing the electric energy, 10 kilowatts capacity in transmission lines, transformers, substation and distribution lines, to supply the demand. In the latter case, 240 kilowatts of generating machinery, 240 kilowatts of line and transformer capacity are absorbed, and that part of the cost of supplying the electric energy, which consists of interest in investment in the plant, of depreciation, etc.—in short, the fixed cost—is twenty-four times as high in the latter as in the former case.

If the fixed cost approximates half the total cost in a steam plant, or is by far the largest part of the total cost in a hydraulic plant, it follows that in the case of concentrated energy used during a short time the cost of electric energy—and with it the price—will be very much larger—many times, possibly —as in the case of a uniform energy consumption.

Thus, due to the absence of storage, the cost of electrical energy essentially depends on the uniformity of the rate of its use—that is, on the load factor, or the ratio of the average consumption to the maximum consumption.

If I use 240 kilowatt-hours of electrical energy in one hour, and nothing during the remaining twenty-three hours, that part of the cost which is the fixed cost of plant investment and depreciation is twenty-four times as great as if I used the same amount of energy at a uniform rate throughout the day. In the former case, if somebody else uses 240 kilowatt-hours, but during another hour of the day, the same plant supplies his energy, and the fixed cost thus is cut practically in two—that is, the cost of energy to both of us is materially reduced.

Thus, again, the cost of electrical energy, and with it its price, depends on the overlap or non-overlap of the use of the energy by different users, the so-called "diversity factor." The greater the diversity factor—that is, the less the different uses overlap and the more their combination, therefore, increases the uniformity of the total energy demand, the "station load factor"—the lower is the energy cost. The cost of electrical energy for lighting, where all the demand comes during the same part of the day, is inherently much higher than the cost for uniform twenty-hour hour service in chemical works, and with the increasing variety of load, with the combination of energy supply for all industrial and domestic purposes, the cost of energy decreases.

Unlike other forms of energy, due to the absence of energy storage, electrical energy can therefore have no definite cost of production, but, even supplied from the same generating station, its cost varies over a wide range, depending on the load factor of the individual use and the diversity factor of the different uses. This feature, of necessity, must dominate the economical use of electrical energy in industrial, domestic, and transportation service.

HOW BOXES ARE MADE BY MACHINERY.

By W. J. Horner.

BOXES are simple things to construct, but nevertheless it does not pay to make them by hand in quantity. It does not matter what their size, shape, or character, may be; whether neatly finished with dovetailed corners, or rough packing cases nailed together; there are machines for making them which will do the work much quicker and at least as well as the most skilful man could do it.

In the construction of a box there are a number of totally different operations to be performed, and each one of these operations requires a special machine. Men or boys are necessary for taking the material from one machine and presenting it to another, but otherwise no hand work is done. Most people are aware that an ordinary sawmill is equipped with machines for sawing and planing wood, and that these machines can be set if required to saw and plane any number of pieces to a particular size, but, in addition to these, a number of special machines are used for box and packing case work.

The Nailing Machine.

The most important and most wonderful of these is the nailing machine. This is as great a time saver compared

with the hand hammer as a circular or band saw is to a hand saw. The nailing machine has superseded the hammer to such an extent in box factories as to make the latter an almost obsolete tool. Instead of two or three blows with a hand hammer on a nail, with the possibility of its not going straight and having to be withdrawn, one stroke only of the machine drives the nail completely home, straight and just where it is wanted. Driving one nail at a time, however, is the slowest work the machine can do. Usually either one line or two lines of nails are all driven simultaneously at a stroke. The machines are constructed with a line of nail-holders and punches above them for forcing the nails down into the wood, and any one or more of these nail holders and punches can be thrown out of operation when the full set are not required.

Nailing machines vary in size, capacity, and design, according to the work required of them, but in all cases they have a table on which the work rests, a series of nail holders above this, and hoppers above these for containing the nail supply. From the hoppers the nails slip down automatically one at a time into the holder or chuck, and are there held upright for driving. The height of the chucks above the table has to be adjustable to suit the work. Adjustable fences are required against which the pieces of wood on edge on the table are pressed to bring them in exact position for receiving the nails in the centre of their thickness.

For nailing the sides and ends of a box together a machine driving a single row of nails at a time is all that can be used advantageously, the box being turned by hand to bring each corner under the nails in turn. For nailing on bottoms, machines with two lines of chucks at right angles to each other are often employed, so that a side and end are nailed simultaneously. Other machines without fences are used for nailing cleats on the sides, ends, bottoms or covers of boxes. These usually drive two lines, or a zigzag arrangement of nails along the cleat, and clinch them also. The clinching is done by having a slot in the table below the line of nail chucks which permits the nail points to come through the wood. The punches are then kept down tight on the nail heads while a hard steel bar fitting in the slot is forced up level with the table surface, thus bending the nail points over and burying them in the wood. In all nailing machines, the driving of nails is controlled by a foot lever, so leaving the hands free for holding the wood in position on the table.

Production of Box Parts.

Lock corners and dovetails are always cut by machines, and this work is further expedited by cutting a number of ends together, the boards being put on the machine in a pile. Boxes jointed in this way are usually glued only. Sometimes they are merely forced together a tight fit without glue. Bottoms are always put on with nails. Setting-up machines are used for putting the boxes together, and these insure them being square, besides saving time and troublesome work. The four pieces which form a box are placed and gripped each in a separate pair of jaws which are arranged in a quadrangle and move inwards towards each other when a foot lever is pressed. Great power is obtained in this way for squeezing the joints together. If glue be used, the ends of the wood are dipped in glue before putting them in the machine.

When planed wood is used, the outsides of the boxes often require trimming at the joints after the parts are together. Special machines of the planer type are employed to do this. Very often small boxes are glasspapered also. For this purpose, ordinary glasspapering machines, generally of revolving disk type, are used. Machines are also employed for making and inserting wire hinges in hinged cover boxes. Designs in ink printed on the wood are done by machine before the boxes are put together. Soda water boxes have wire or hoop-iron straps put on, and the hand holes cut in the ends by machines designed for the purpose.

The manufacture of cardboard boxes is a larger industry than that of wood boxes, and the varieties of machines employed for the purpose are more numerous. These are mostly for cutting, flanging or bending, and pasting. The manufacture of tin boxes is also a large industry. In this the machines mostly used are for cutting, pressing, and stamping. The time occupied is so little that the value of a box is scarcely any more than that of its material.

COMING CONVENTIONS.

Master Car Builders.—Atlantic City, June 10. Joseph W. Taylor, secretary, Karpen building, Chicago.

Railway Electrical Engineers.—Atlantic City, June 10. J. A Andreucetti, secretary-treasurer, C. & N. W. Ry., Chicago.

Railway Supply Manufacturers' Association.—Atlantic City, June 10-17. J. D Conway, secretary, 630 Oliver building, Pittsburgh.

American Society of Mechanical Engineers.—June 16-19, Minneapolis (headquarters at University of Minnesota). Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York.

American Institute of Chemical Engineers.—Troy, N.Y., June 17-20. J. C Olsen, secretary, Brooklyn Polytechnic Institute, Brooklyn, N.Y.

Railway Master Mechanics.—Atlantic City, June 15-17. Joseph W. Taylor, secretary, Karpen building, Chicago

American Society for Testing Materials.—Atlantic City, June 30-July 4 (headquarters Hotel Traymore). Prof. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Pa.

Railway Tool Foremen's Association. — Chicago July 20-22. A. R. Davis, secretary-treasurer, 730 Pine street, Macon, Ga.

Railroad Master Blacksmiths. — Milwaukee, August 18-20 A. L. Woodward, secretary, C., H & D. Railway, Lima, O.

American Foundrymen's Association. — Chicago, September 7-10 (headquarters Hotel LaSalle). A. O. Backert, secretary, Penton building, Cleveland.

Railway Bridge and Building Association. — Los Angeles, October 20-22. C. A. Lichty, secretary, C. & N. W. Railway, Chicago.

Bridge and Building Supply Men's Association. —Los Angeles, October 20-22. H. A. Nealy, secretary, Joseph Dixon Crucible Company, Boston.

Railway Electrical Manufacturers' Supply Association. — Chicago, October. J. Scribner, 1010 Monadnock building, Chicago.

Replacing Belts on Pulleys.—A number of appliances, both portable and fixed, have been designed for replacing belts on pulleys from the floor level. For belts not exceeding 3 in. wide, states the writer of an article in Vulcan, an ordinary belt pole may be used. This is a strong, light pole about 1½ in. diameter, carrying at its upper end a wrought iron pin at right angles to the axis of the pole. The length of the pole should not be less than the height of the shafting above the floor level. There is risk of accident with a short pole, as the lower end is liable to be driven forcibly towards the workman. A rigid belt pole is unsuitable in many cases, and its use may be considerably limited by position, size, length, tension, or direction of the belts, or by such obstructions as pillars, beams, and walls. Various types of jointed and flexible belt poles have been devised to overcome these difficulties; a flexible pole is probably safer to handle than one of the rigid type. When the belts are too heavy or the shafting too high to allow the use of a belt pole, mechanical belt shippers enable the belt to be replaced on the driving pulleys from the floor level with perfect safety, without stopping or slowing the transmission machinery.

Blue Print Reproduction.—The making of a blue print from a blue print is described by a correspondent of the Concrete Record as follows: — To obtain good results, a clear, sharp, and rather dark print is essential, for if it be blurred or light it will not reproduce satisfactorily. The method consists of coating the print with a little kerosene and then printing immediately. The oil used will not affect the reproduction of the new print, unless it is applied very thickly, nor will it spoil the original, as the oil soon dries, leaving the print in as good condition as before. This process, it is stated, will also work perfectly when it is desired to make prints from heavy drawings. It has been used with success to make blue prints from printed matter. To make the original perfectly transparent, a coat of boiling hot paraffin is applied.

MACHINE SHOP METHODS AND DEVICES

Unique Ways of Doing Things in the Machine Shop. Readers' Opinions Concerning Shop Practice. Data for Machinists. Contributions paid for.

PLATE LAY-OUT.

By Joseph W. Ross.

In these articles on plate lay-out an endeavor will be made to explain the general principles without technical verbiage likely to confuse the uninitiated. It is desired to help out the young mechanic, who does not care to give the time necessary to the study of geometry and projection, required in some of the problems that occur in the developing of sheet iron and also heavy plate. The student is strongly advised to practise in his spare time the exercises which will be explained and illustrated from time to time.

It is not necessary to have an elaborate drawing outfit; a pair of compasses, rule, pencil, and some drawing paper will be quite ample to begin with. Making models on stout paper of the problems set forth is highly recommended for practice, so that the student may familiarize himself with the general shapes and forms. He will thus be able to grasp the subject more readily. Plane or flat surfaces, cylindrical, conical and irregular curved surfaces will each be dealt with and illustrated by a few general examples.

The Tools Feature.

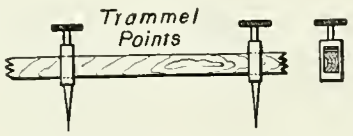
A few words about the tools will not be out of place at this stage, although no doubt everyone is more or less familiar with them. Trammel points, or trams, is a device with two separate steel points fitted to two metal blocks. These blocks have slots, through which runs easily a rectangular rod of iron or hardwood. A knurled screw permits the trams to be clamped at any desired distance apart. The trams are used for circumscribing large circles and arcs, and for dividing and subdividing lengths. The dividers are for spacing rivet holes and also for drawing small circles.

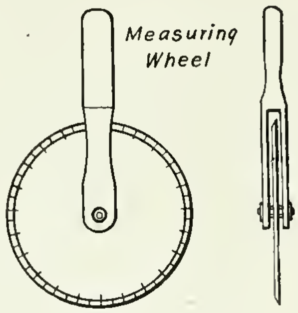
The measuring wheel is an instrument for measuring curved lines. It is a flat circular disk, beveled at its edge, and pivoted at the centre to a handle. The circumference of the wheel is generally made to a standard of 2 feet or 3 feet, with inches and parts of inches graduated on its edge.

All points of identification and locations should be lightly centre punched, while short straight lines are drawn in with a straight-edge of seasoned hardwood or with a length of steel, planed straight. Long straight lines are marked on the sheet by snapping in with a chalk line. This is a length of fine string or cord (a fishing line makes an excellent chalk line) covered with chalk by rubbing the chalk over the cord. The line is drawn taut and held at each end of the plate; the cord being then raised at the centre a few inches and allowed to snap back to the plate, leaving a fine clear straight line if the operation is performed correctly.

Squaring the Plate.

The first and most important operation in plate lay-out is the "squaring up" of the plate. By "squaring up" is meant making the four edges of the





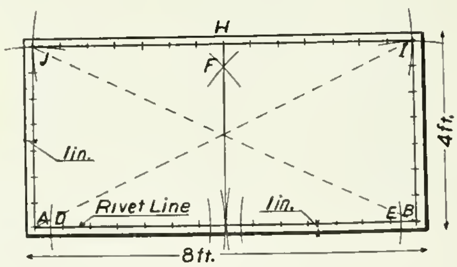


FIG. 1. PLATE LAY-OUT.

plate conform to a perfect rectangle; that is, having its opposite sides parallel and its angles right angles. Small plates may be readily squared with an ordinary two-foot steel square. For squaring up large plates, the method of procedure is as follows:—

Assume that the squared plate is to be 8 ft. x 4 ft. and the line of rivet holes is 1 inch from the edges. Measure 1 inch from the edge of the plate as shown in Fig. 1 at AB, connect these two points by snapping in a straight line with a chalk line. Then with the trams at centres A and B respectively, and with a trial radius equal to about half the length of AB, strike the arcs as shown, reset the trams to half the distance between the trial arcs, and strike the arcs again; this second trial will most likely give the exact centre of the line AB. With centre C and with any radius strike the arcs DE, and with the same radius, or larger, as the case may be, and with centres D and E, strike the intersecting arcs at F. Let F be struck near the top of the plate, as this gives greater accuracy. Connect C to F by a straight line.

The line CF is now at right angles to the line AB and equidistant from the points AB. Mark off on the line CF a distance equal to 4 feet less 2 inches, as this is the line of the rivet holes at the top of the plate. With the trams set to this distance, place the points on A and B respectively, and strike the arcs J and I. With the radius AC or CB (which are equal), and with H as centre, strike the arcs cutting at I and J. Connect by straight lines J to I, J. to A, and I to B. If the work has been accurately done, the diagonal distance J to B is equal to I to A. Mark off 1 inch from these lines for the edges of the plate. This completes the squaring up. The rivets are stepped off with the dividers along each line. For stepping off the holes the dividers are set to a trial distance, and if it does not space out correctly to the desired number of holes, the dividers are reset or adjusted for another trial until the spaces are equal.

The reader may think there is an unnecessary amount of work to obtain the squaring up of the plate; but it is absolutely necessary for this method to be followed to obtain good results, and it is the best practical as well as geometrical method of obtaining this result. It is the method adopted by all first-class workers, and is not so difficult as it may appear at first glance to the learner. The interested reader is strongly advised to practise this exercise on paper in his spare time, as a few trials will quickly enable him to memorize the method.

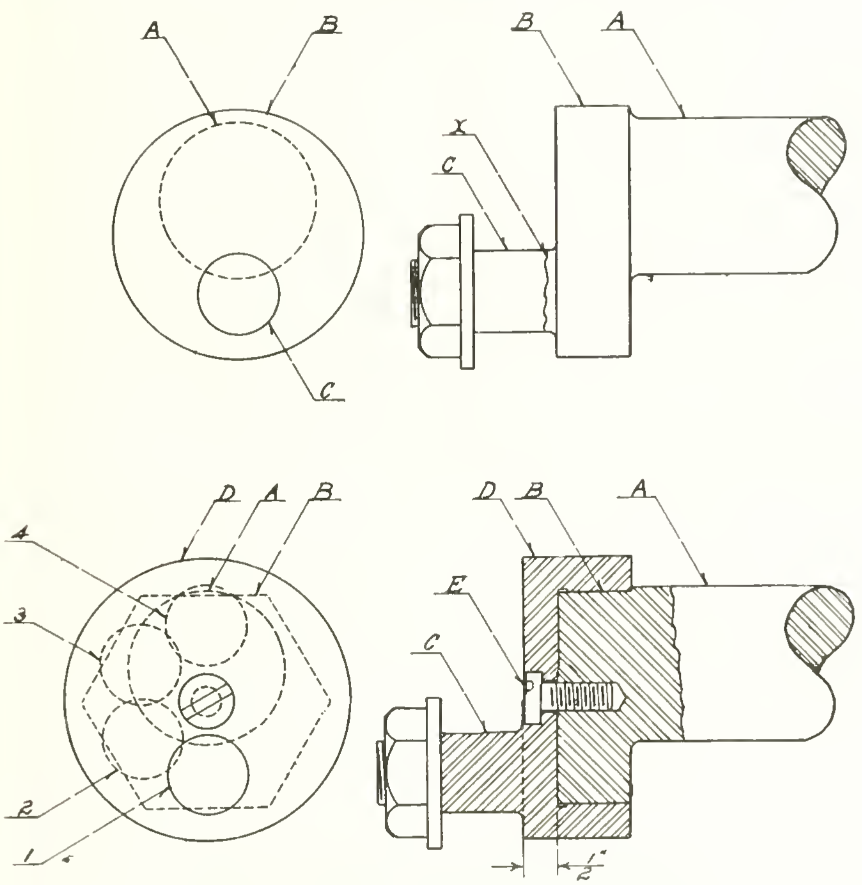
In the absence of the regular trammel points, rough and ready improvised trams may be constructed out of a light wooden batten, through which a couple of nails can be driven to act as the points.

Alexander Armstrong died at his home in St. Thomas, Ont., on May 24, after a long illness. Mr. Armstrong conducted on iron foundry in St. Thomas for many years.

REPAIRING A BROKEN CRANK SHAFT.

By J. H. Rodgers.

THE accompanying sketch shows the repairs made on a small slotting machine crank shaft. The collar B on the crank shaft was milled to a hexagon shape, the piece D being made to fit, and secured by means of the screw E.



FIGS. 1 AND 2. REPAIRING A BROKEN CRANKSHAFT

The original crank, as shown in Fig. 1, had a permanent stroke of 3 inches, while the repair made possible four different strokes—1¼ in., 2 in., 3 in., and 3½ in., a great convenience on certain work.

Although not as rigid as the solid crank, the repair was very satisfactory.

MODERN SCIENTIFIC SELLING.

By D. A. Hampson.

I DROPPED into Scotty's the other night to get a spring haircut. You know Scotty and I were chums as boys, and Scotty is as crazy to "barb" as I am to run a lathe. Quite naturally he made a good barber, and he was a first-class man with the edge tools of his profession—no saw-tooth razors or hair pulling shears in his sets.

As he dexterously clipped on the two months' growth, he talked. "How do you like the feel of these shears?" he said.

"Fine as always," I replied.

"Well, I notice a difference, even if you don't; they are sharpened a new and a better way. You know I sharpened my shears on that little motor grinder in the back room, used a very fine steel, and stoned them up a little by hand. That gave my blades a perfectly smooth, continuous edge, really too much so, for they pushed the hair along thead and made trouble for the barber and the customer. What is wanted is an edge that is broken up ever so little, but that little forms minute notches that hold the hair from slipping away. You can't get it by grinding, because you can't help overdoing it.

"It can be done, however, with a special file I bought. Last month Hock's drummer was in here (Hock is to barbers' supplies what Morse is to drills), and showed me the new shears file they are selling. It is an imported file, comes from Australia, and is made by a secret process of special steel. It cuts the hardest blades and gives them that fine serrated edge that I was telling about. I gave him my oldest shears and he sat down and in two minutes had an edge on them. I've got 'em in my hands now, and they're great, I tell you.

"The price of the file was $2, but I put up a kick and he let me have it for $1.75. The drummer showed me how to do the trick and I can sharpen as well as he. Will show you the file as soon as I get you brushed off. They're put up fine, too, and all wrapped in a fancy box."

I took the box he handed me and opened it. The file lay carefully wrapped in a heavy oil paper in a bed of cotton wadding. I examined the tool carefully. It was a particularly good-looking 8 in. file, very fine, with a peculiar "over" cut that I could readily see would produce the edge described. Lastly I looked at the tang.

"What is that?" XFWAAA. Australian? No. "XFW" stands for the Excelsior File Works down in Orangeburg. I knew the shop and the men and the product very well.

That "AAA" was undoubtedly the brand of the new high-speed steel files that I had heard they were bringing out. They sold for 40c. at the factory. Scotty's file had never been nearer to Australia than it was at present, and Scotty had been "stung." The Excelsior Works had boys on the road, too, but they never got over 40c. for what the more enterprising barbers' supply house got $1.75. The latter bought the file in quantities, repacked them, and sold them to a special trade at a special price.

I took a look at the box. Perhaps there was something more. It was a first-class piece of work. The cover bore a handsomely lithographed label. The name of the file occupied a large centre space flanked on one side by the two hemispheres in miniature and on the other by a kangaroo, poised for a jump. Very explicit directions for the use of the file were added. Light blue wadding of good quantity filled the box. There was nothing more.

I handed back his purchase to Scotty, complimenting him on it, for obviously he could get his money's worth out of it and more. Then I paid him and went out. As I walked up the street I tried to find an answer to one of two questions that were uppermost in my mind—whether the barbers' concern was guilty of sharp practice in charging outrageously for a little packing, or whether the file works were slow and unprogressive in not catering to a special trade that could be so easily and profitably bled.

APPROXIMATE RULES FOR ARCHITECTURAL STEELWORK.

SOME useful approximate formulae are to be found in a paper on "Calculations and Details for Steel-Frame Buildings from the Draughtman's Standpoint," recently read before the Concrete Institute by Mr. W. C. Cocking.

The author states that the section

modulus of an I beam is given approximately by the expression.

$$M = \frac{Ws\ d}{10},$$

where Ws denotes the weight of the section in pounds per foot run, and d its depth over flanges in inches. The safe load on 1-ft. span for I sections is approximately

$$\frac{Ws\ d}{2}.$$

the corresponding stress being $7\frac{1}{2}$ to 8 tons per sq. in.

For I beams used as pillars, the safe load is approximately equal to the safe load per foot run on a span, which measured in feet is equal to twice the width of the flange in inches, the load being taken as applied laterally, and the column considered as fixed at both ends. For a stress of $7\frac{1}{2}$ tons per sq. in., the section modulus required is $M=0.2\ w\ L^2$, where w denotes the load in tons per foot run, and L the span of the beam in feet.

The approximate weight of a beam to carry a given load is

$$Wb=\frac{W\ L^2}{1000d}$$

where Wb denotes the weight of the beam in tons, W the total equivalent uniform load in tons per foot run, L the span in feet, and d the depth of the beam in inches.

The weight of a column is approximately

$$Wp = \frac{WL}{C},$$

where C is 2500 for both ends fixed, and 2000 for one hinged and the other fixed. In this case, W denotes the total central load on the column, and L its laterally unsupported length in feet. The weight of a beam-casing is approximately

$$Wc=0.00035\ b\ d\ L,$$

where Wc = total weight of the casing in tons, b the breadth, and d the depth, both in inches, whilst L is the length in feet. The same formula applies to columns.

For calculating the effect of eccentric loads on columns, Mr. Cocking recommends the following factors:—For I sections the equivalent central load

=$1\frac{1}{2}$ times eccentric load if latter is connected to the web of the I beam,

=$2\frac{1}{2}$ times eccentric load if the connection is to a flange.

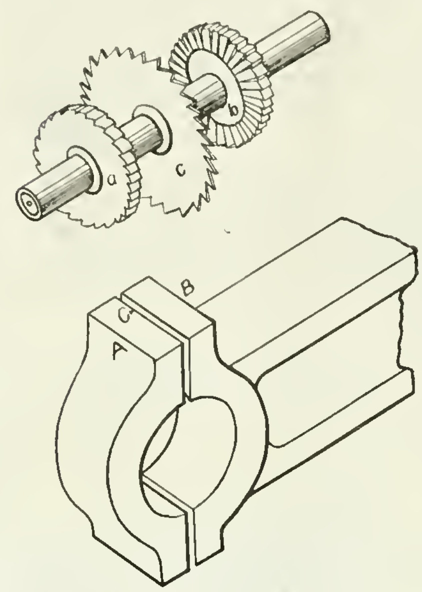
The corresponding factors for an I-beam column with plates over each flange are $1\frac{1}{4}$ and $2\frac{1}{2}$ respectively.

For a double I section, with plates riveted to each flange, the factor is greatest when the connection is made to the web of one of the I's and may be taken as $2\frac{3}{4}$ times the eccentric load.

MILLING CONNECTING RODS.

By A. V. Francis.

THIS illustrates a method used in milling connecting rods for gasoline engines, where a milling machine was not



MILLING CONNECTING RODS.

available. The milling cutters were arranged on an arbor as indicated, and the connecting rod fastened in a fixture on the cross slide of the carriage, so as to be fed under the cutters by the power cross-feed.

Although this seems a comparatively crude method and was done on a lathe that had seen its best days, so that the tool equipment cost very little, the output was larger than might be imagined and, in fact, compared quite favorably with many milling-machine operations, although it is not illustrated as being the best way to do this kind of work.

TENSION ON CYLINDER STUDS.

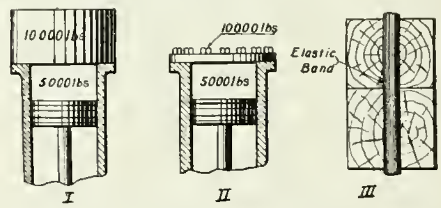
By N. G. Near.

I CANNOT refrain from offering my views on the cylinder cover stud question in which I agree in part with Mr. Rodgers. When steam is turned into a cylinder there must be an increase in tension in the studs, but that increase is very small in proportion to the initial tension produced by tightening the nuts.

This pressure slightly compresses the nut and the cover and there must be some compression also in the cylinder itself. All materials, including cast iron and steel, are elastic, the stud alone being elongated. As soon as steam is turned on, a small part of the initial compression in cylinder and cover will be relieved, with the result that there will be a slight increase in the tension of the cylinder bolts, but, as mentioned before, this increase is practically negligible.

A glance at the two cylinder ends shown will make this clear. Fig. 1 is closed steam-tight by means of a 10,000 pound weight, while the joint of Fig. 2 is made in the usual way with the cover pulled down by a total force of 10,000 pounds. The nature of the pressure at both steam joints is about the same and the pressure per sq. in. of metal against metal would be computed in the same way. The real difference is that one joint is elastic and the other is not. The weight in No. 1 would not have to be increased until the total pressure of the steam exceeded the applied load. The studs, on the other hand, are stretched and the tension is correspondingly increased until the slight compression of the metal of the cylinder is relieved. After this takes place, the pressure of the head against the studs is simply transferred from the cylinder body to the steam and little further increase in tension takes place. The exact amount of the increase in tension, of course, would be hard to measure.

Another illustration is shown in Fig. 3, which consists of two blocks of wood held together by a rubber band to represent the elastic tendency of the studs and a thin sheet of rubber between them to represent the elasticity of the cylinder cover and packing. It will be found that the slightest pull stretches the



TENSION ON CYLINDER COVER STUDS.

outer band until the very small compression between the blocks is relieved. Beyond this the blocks will not be separated until a pull is applied equal to the tension of the band.

Question.—A dam is 30 ft. high, and 100 ft. long. What is the total pressure tending to move it from its foundations?

Answer. — Formula = $P = \frac{1}{2}\ w\ h^2$ for every linear foot of dam.

In which

P = total pressure in pounds.

w = weight of cu. ft. of water = 62.34 lbs.

h = total weight of water in feet.

In above case, pressure per foot of dam = $P = \frac{1}{2} \times 62.34 \times 30 \times 30$.

Total pressure is

$$\frac{62.34 \times 30 \times 30 \times 100}{2 \times 2000} = 1402.65 \text{ tons.}$$

DEVELOPMENTS IN MACHINERY

A Record of New and Improved Machinery Tending Towards Higher Quality and Economical Production in the Machine Shop, Blacksmith Shop or Planing Mill.

NORTON GRINDING WHEEL STANDS.

A BULLETIN has just been issued by the Norton Company, Worcester, Mass., descriptive of new design (Model D) of floor type grinding wheel stands, equipped with a new design protection and dust hoods. These stands are manufactured with 1¼-in., 1½-in., 1¾-in., and 2-in. spindles, and we understand a 2½-in. machine will be supplied on order.

This new design is an outgrowth of the experience of Norton Company in the use of their grinding wheels on the many types of floor stands now on the market, and the designers have endeavored to incorporate into it every feature that will help to obtain greater production and to give longer life to the grinding wheels and the machine itself. Although not a radical departure from the machines now common in the better equipped shops, it is evident that its designers have given much thought to such features as rigidity, safety, convenience of operation, ease of repair and interchangeability of parts, lubrication and dust removal. Particular attention has also been paid to general appearance as indicated by freedom from sharp corners, recesses and uncovered bolts, and to provision against too frequent replacements by increased weight, oversize spindles and chilled work rests.

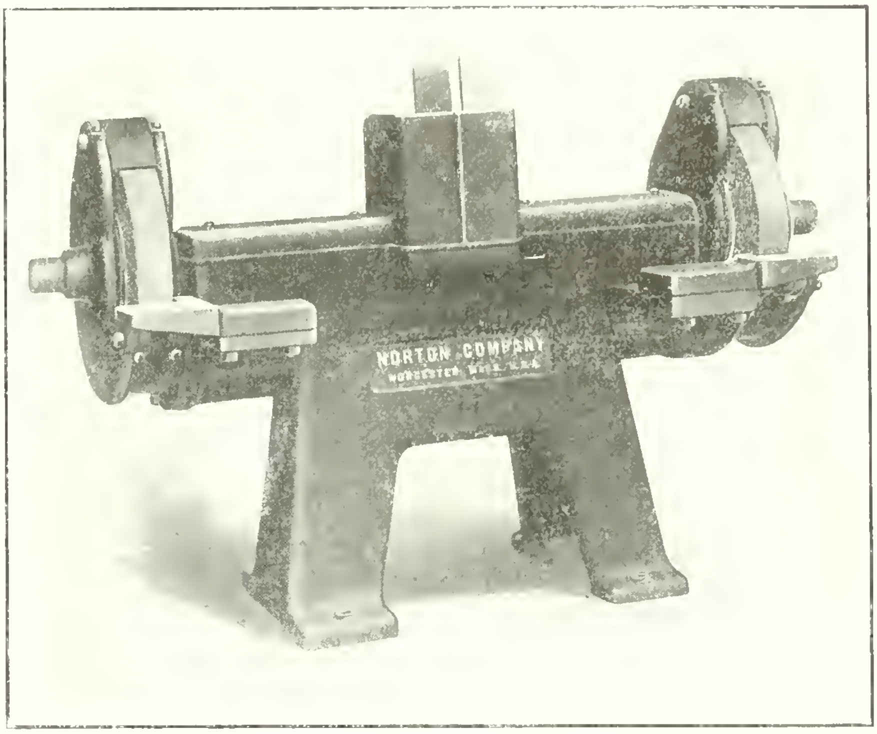


FIG 1 "MODEL D" GRINDING WHEEL STAND

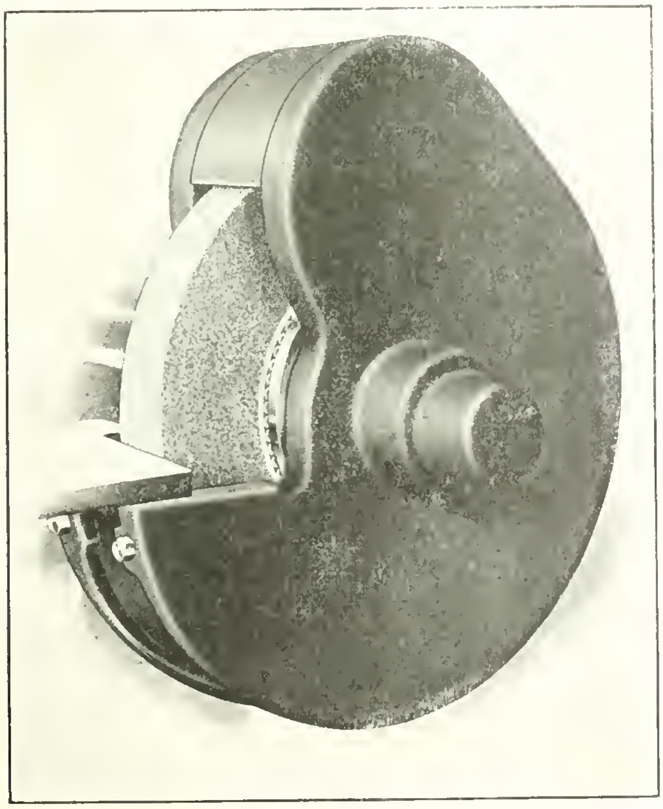


FIG. 2. "MODEL D" PROTECTION AND DUST HOOD (CLOSED)

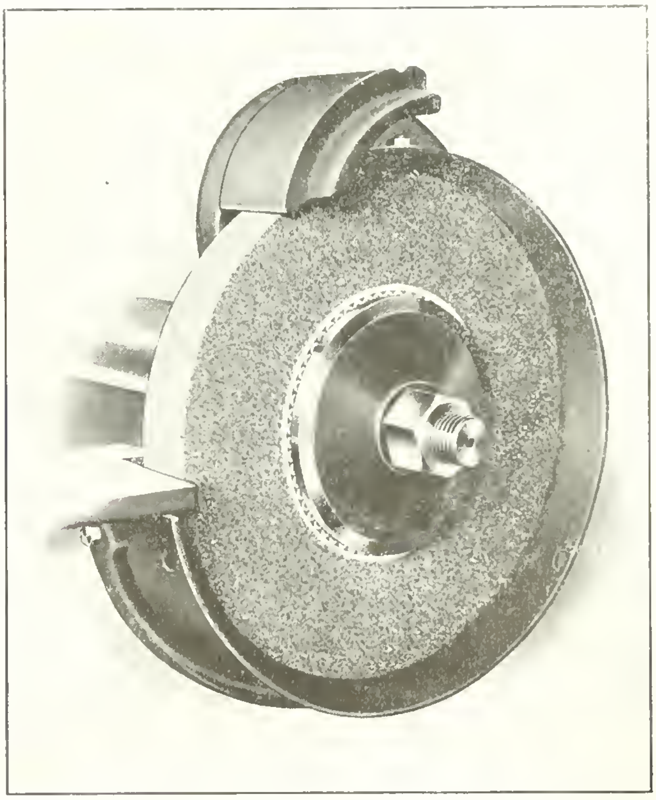


FIG. 3. "MODEL D" PROTECTION AND DUST HOOD (OPEN).

While the foundation space occupied by the machine is small, its weight and rigidity permit of a very desirable overhang of the bearing-bed. This feature allows ample foot-room for the operator. Each bearing is divided into two parts, and the large bearing surfaces help to insure long life. The diameter of the spindle in the bearings is made 1/16 in. oversize, allowing sufficient stock for regrinding when this becomes necessary. The portion of the spindle outside the bearings is made sufficiently long to take taper wheels (½-in. or ¾-in. taper per foot), which have the same width of face as the maximum width of straight wheels. End play on the spindle is easily taken up. The inside flanges are fitted loose on the spindles and driven by a key, making their removal a simple matter. Taper flanges of any make may be used on these machines, if the hole be the right size, by cutting a spline in the hole of the inside flange to fit the square key in the spindle.

Oiling is accomplished by the splash system, insuring positive lubrication. The oil reservoir, under and between the two parts of the bearing, holds a supply of oil sufficient for several months. The design allows ample space for the oil to drain back into the reservoir and be used over and over. All lubricant can be easily and quickly removed from the reservoirs, which are readily accessible for cleaning. Dust-proof covers protect the bearings and oil chambers, and an oil guard inside the bearing-chamber prevents the oil thrown up by the splasher from working out through the joints of the bearing-bed and bearing-cover.

The underside of the overhanging bearing-bed is provided with a machined seat and tee-slots. Work rest brackets, protection hoods and surface grinding attachments are secured by bolts placed in these tee-slots, and may be attached or removed very quickly. All attachments are independent and interchangeable. Whenever it is desired to grind large work that requires the removal of the work-rest, the work-rest bracket can also be removed. This permits the grinding of large pieces without interference by projecting brackets even if the wheel in use be of minimum diameter. The top surface of the work-rest is chilled, insuring longer life, and is considerably increased in size to give adequate support for large and heavy work.

A substantial belt guard, which permits any belt angle from the vertical to 45°, extends two inches above the top line of the maximum size of wheels. This, besides affording protection to the operator, serves to protect the belt when long pieces are ground on the surface grinding attachment. A protection and dust hood, designed especially for the **Model D** floor stand, has the double function of providing protection not only against injury in case of accident to the wheel, but also, when the hood is connected with some suitable dust removal system, against injury to health from inhalation of dust. The bracket which supports the hood serves also as a dust exhaust pipe.

The closed hood consists essentially of a heavy band of boiler plate and two heads or side plates. The hood surrounds about five-sixths of the wheel, leaving a 60° opening. A heavy steel slide provides adjustment for wheel wear. The slide travels in grooves describing an arc around a centre other than the spindle centre, so that, irrespective of the size of wheel, 60° of the periphery of the wheel is exposed for grinding purposes and protection is always afforded. This type of hood covers the end of the spindle, thus preventing an accident due to clothing becoming caught in the thread of the spindle. Through the employment of a special lock nut, the outer head or side plate is easily removed to permit change of wheels.

In addition to the **Model D** type of hood, the Norton Company are also placing on the market a **Model E** hood, designed along the lines of the **Model D**, adaptable to any make or floor stand conforming to the general contour of the Norton stands, it being necessary for the purchaser to provide a suitable bracket, to which may be attached the inner head, which in turn holds the entire structure. This hood is so designed that it is adjustable about the wheel, permitting the grinding to be done on top, at the front, or at the bottom of the wheel. Instead of the bracket, by means of which the hood is fastened to the wheel, serving also as a dust exhaust pipe, the inner head of the hood is solid,

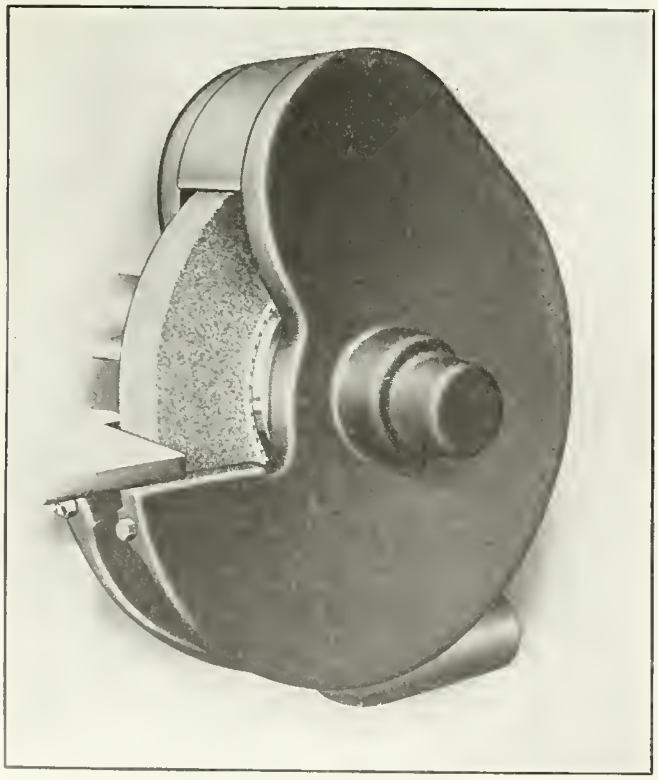


FIG. 4. "MODEL E" PROTECTION AND DUST HOOD (CLOSED).

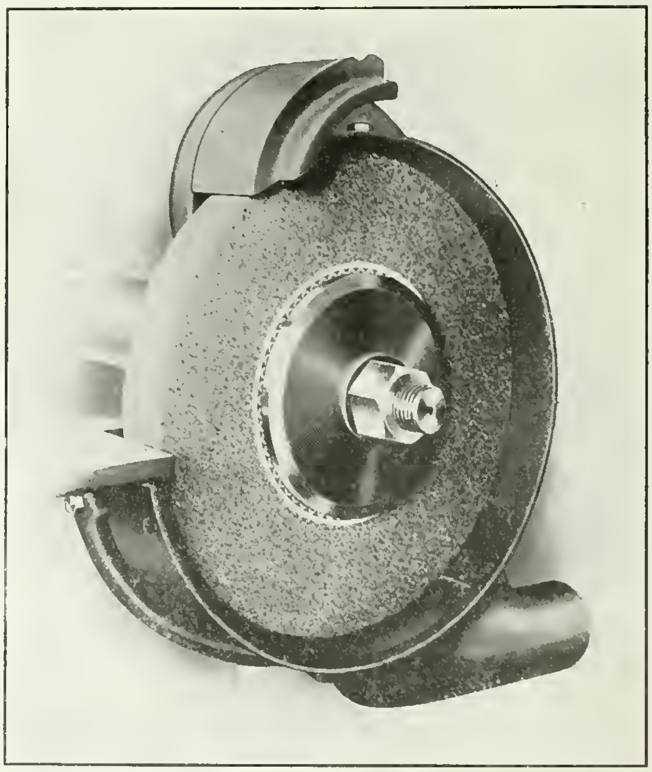


FIG. 5. "MODEL E" PROTECTION AND DUST HOOD (OPEN).

and the exhaust pipe is located on the boiler plate band. The exhaust pipe is mounted on a steel plate of the same radius as the band, and is firmly bolted to the latter.

Model E hoods are furnished with full size band, and the exhaust connection

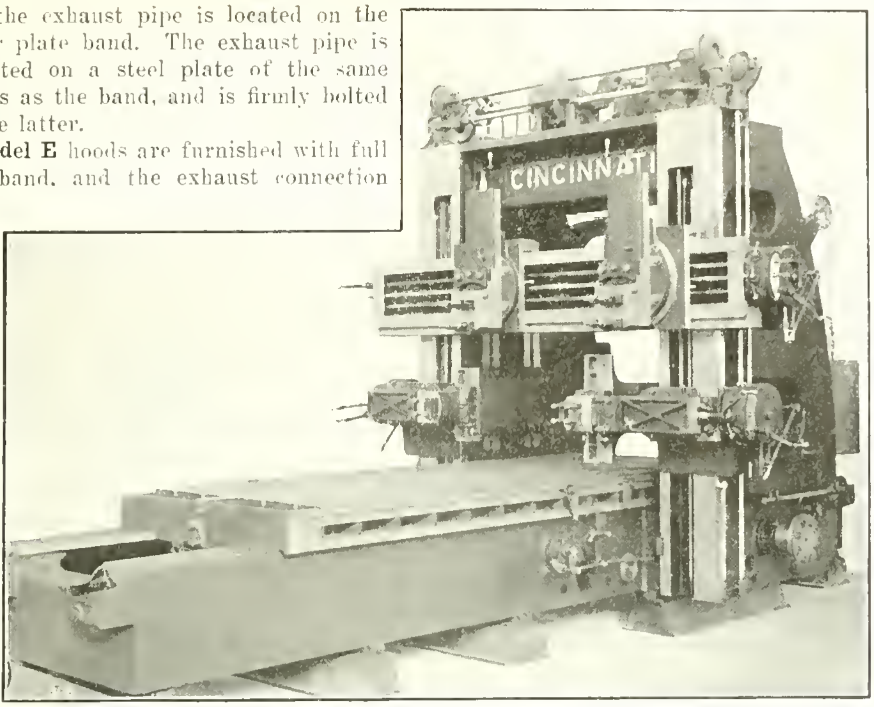


FIG. 1. CINCINNATI LOCOMOTIVE CYLINDER PLANER.

is not attached. The user can readily cut the opening in the band at any desired point and attach the exhaust connection after the hood is located on the machine. The principal dimensions of the 2-inch machine are as follows:—

Diameter of spindle between flanges, 2 ins.; distance between wheels, 62 ins.; entire length of spindle, $79\frac{3}{4}$ ins.; height from floor to centre of spindle, $30\frac{1}{2}$ ins.; length of bearings, $16\frac{1}{2}$ ins.; diameter of spindle in bearings, 2 3/16 ins.; diameter of flanges, 12 ins.; floor space, 27 ins. by $88\frac{1}{4}$ ins.; size of wheels (maximum), 24 ins. by 4 ins.; weight of machine and hoods, 1,705 lbs.

CINCINNATI LOCOMOTIVE CYLINDER PLANER.

THE illustrations herewith show a 72-inch locomotive cylinder planer built by the Cincinnati Planer Co., Cincinnati, Ohio, and recently supplied to the Canadian Pacific Railway for their Angus shops, Montreal. It has been specially designed for planing locomotive cylinders complete at one setting, and the method of doing this may be readily seen from Fig. 2.

One of the chief features of the planer is the arrangement of the side heads. These are provided with patented adjustable brackets, which give ample support to the heads when reaching far out into the machine, as when planing frame fits, etc. The brackets have a tongue which fits into planed tee slots on the inside of the housings. They are adjustable to suit various types and sizes of cylinders, and can be used in any position between the top of the table and the bottom of the rail. A vertical sliding shoe fits the front of these brackets, and has a dovetail on which the cross-slide of the slide head slides when the latter is fully extended. This design eliminates the twisting strain on the front of the housing, which is caused by the long overhang of the slide and the upward pressure of the tool. If the planer is to be used on other than cylinder work, the slides of the side heads are run back, and the supporting brackets are removed, this being a simple operation.

Each head has rapid power traverse in any direction, controlled by the long levers seen at the side of the heads. These are easily engaged and have a neutral position when not in use. The housings are tied very rigidly together at the top by a heavy box arch, and at the bottom are locked to the side of the bed by large tongues, dowels and bolts.

The table is of the box type and runs on vees that are oiled by forced lubrication supplied by a pump which is driven

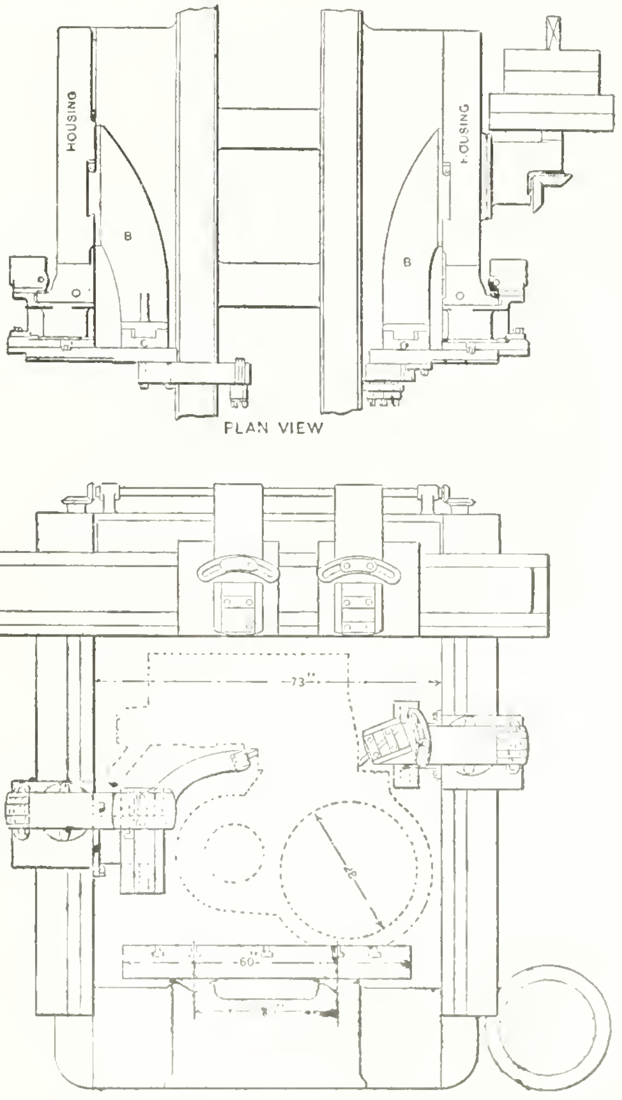


FIG. 2. CYLINDER PLANER SHOWING METHOD OF SUPPORTING SIDE HEADS WHILE PLANING THE FRAME FITS.

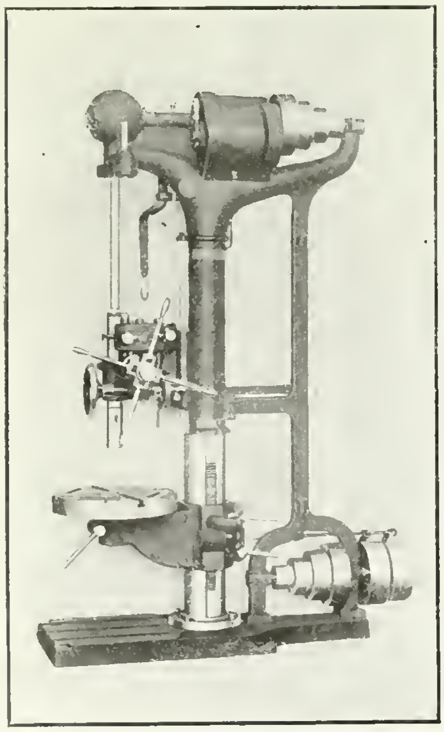
by a belt from one of the shafts on the top arch. This planer can be arranged for either electric variable speed motor, reversible motor, or belt drive.

The machine supplied to the Canadian Pacific Railway is driven by a "Lancashire" reversing motor operating on the Lancashire system of planer control off a 3-phase, 550-volt, circuit. The motor gives cutting speeds on the planer of 15 feet to 45 feet per minute, with a return speed of 90 feet per minute. About thirty cutting speeds between the above limits are provided, these being obtained by movement of the speed regulator handle. Push buttons are provided on each side of the planer for starting and stopping.

The drive was supplied by the Lancashire Dynamo & Motor Co., of Canada, who state that their system is the only one that can be operated on an alternating current circuit. For short stroke work, such as cylinder planing, an increased efficiency of at least 40 per cent. is claimed over a belt drive. Moreover, with a reversing motor drive, the variation of length of stroke is negligible, so that the difficulty usually experienced with belt driven planers when planing up to a shoulder is not met with.

HIGH-SPEED VERTICAL DRILLING MACHINE.

ANOTHER improved design of vertical drilling machines is herewith illustrated. The manufacturers, recognizing the growing demand for a more perfect lubrication of the high-speed moving parts of this class of machinery, which on account of their position are generally neglected by the operator, have completely encased in fixed oil retaining housings the friction back gears and spindle-driving gears. This method of lubricating trains of gearing has been applied to some classes of machine tools.


HIGH-SPEED VERTICAL DRILLING MACHINE.

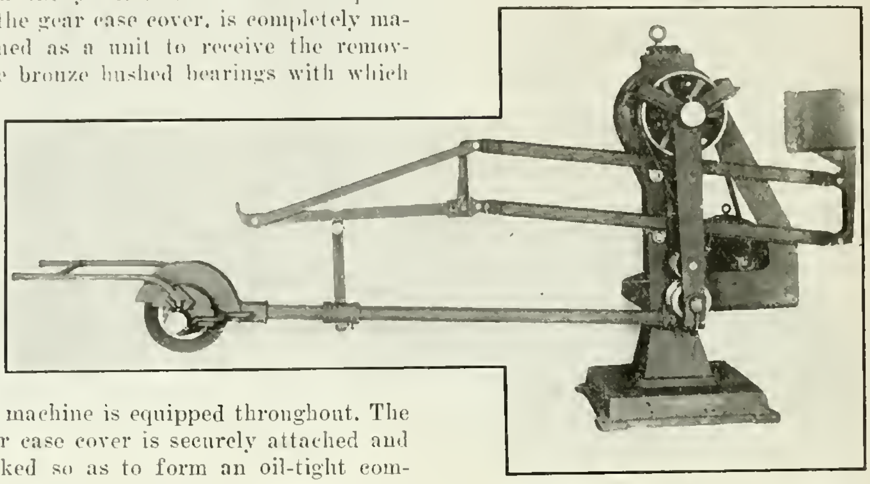
The back gear case is cast integrally with the yoke, and with the exception of the gear case cover, is completely machined as a unit to receive the removable bronze bushed bearings with which the machine is equipped throughout. The gear case cover is securely attached and packed so as to form an oil-tight compartment to enable lubrication by the splash system. One supply of lubrication will last for months with the assurance of no moving parts being subjected to unnecessary wear. This construction protects the bearings and gearing from dirt, confines the gear noises, and avoids the throwing of oil on operator or floor.

The machine illustrated is 21 in. size, and is the product of the Superior Machine Tool Co., of Kokomo, Indiana.

PORTABLE RADIAL SWING GRINDER.

THIS grinding machine is made for the purpose of grinding large and medium-sized castings and doing other general buffing work. It will perform the various functions of a stationary swing grinder and many others that cannot be done on a swing grinder permanently installed. The grinder is wholly self-contained, and is driven by a motor mounted on a suitable platform which is part of the main housing. The counterbalance for the swinging arm and grinding head is also mounted on the main housing. The machine may be put in any convenient place in the shop, and needs no preliminary work for setting up. Its portability permits it to be carried anywhere by a crane and placed at the work, while the eye on the top of the pedestal makes it convenient for hooking to the crane.

It is a complete radial grinder, the arm with the grinding head turning the entire circumference about the base. The grinding head and the swinging arm is carried back and forth by a roller-bearing trolley which rolls on a track held in a horizontal position by two parallel arms. At the back or other end of these arms is placed the counterweight. These parallel arms keep the head balanced for any position of the trolley on the track. This arrangement gives a free and easy movement to the swinging arm and eliminates the tendency of the latter with its weight finding its centre of gravity, generally an annoying feature. The grinding head can be twisted in either direction, to the right or to the left to an angle of 90 degrees. The emery wheel is driven by a single belt which is carried around the jointed connection of the swinging arm and hanging swing frame, by two self-oiling idler pulleys, thence to the large pulley at the top. The upper pulley is driven by a shaft from the drive pulley on the inside of the housing. To this drive pulley the motor is belted.


PORTABLE RADIAL GRINDER.

The machine is mounted on a substantial base which supports a vertical pedestal. On this pedestal is mounted the main frame or housing which is free to turn thereon. On the side of the housing is placed a strong bracket carrying the swing frame in which the pulleys are carried. At the lower end of this frame is jointed the swinging arm to which the grinding head is attached at its outer end. The swing frame hangs on two phosphor bronze bushings put through the top bracket, these bushings forming the bearings for the drive shaft.

The emery wheel in the grinding head is shielded by a hood over the top, while the handles attached to the head enable the operator to get a good hold, and to have full control of the head. The wheel arbor runs in phosphor bronze bearings having provision for taking up the wear. It has safety flanges and will take a wheel 18 inches diameter by 3 inch face. A safety shaped wheel is recommended.

The machine, which is rigidly and strongly constructed to withstand hard service, is a product of the Mummert-Dixon Co., Hanover, Pa.

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Attention is drawn to the alternating course in arithmetic, a concurrent study of which is recommended with that of the Question and Answer Series.

PROBLEMS IN HYDROSTATICS.

HYDROSTATICS deals with the equilibrium of liquids or with liquids "at rest," whether under pressure or not.

A cubic foot of water weighs 62.35, or approximately $62\frac{1}{2}$ pounds. The weight of a cubic inch is .036 pound. As water is very nearly incompressible, it is particularly useful for transmitting great pressures.

If a body is submerged in water, it is pressed upwards with a pressure equal to the weight of water it displaces, and it is subjected to a pressure equal to the weight of the water above it.

If a liquid be subjected to pressure, that pressure is transmitted equally in every direction except in cases where the weight of the liquid naturally adds itself to the downward pressure.

* * *

Question.—A cylindrical tank, 20 ft. high, is filled with water. What would be the downward pressure on the bottom and the lateral pressure at a point three feet from the bottom in pounds per sq. in.?

Answer.—The pressure on the bottom would be equal to the weight of a column of water one inch square and 20 ft. high, which is

$20 \times 12 \times .036 = 8.64$ lbs. sq. in.

The lateral pressure three feet from the bottom would be

$(20-3) \times 12 \times .036 = 17 \times 12 \times .036 = 7.344$ pounds.

* * *

Question.—The steamer Titanic is supposed to be five miles below the surface of the ocean. What would be the external pressure in pounds per sq. in. upon one of her boilers, which happened to be closed up at the time of sinking?

Answer.—Five miles $= 5 \times 5280 = 26400$ ft. Pressure per sq. in. then is
$26400 \times 12 \times .036 = 11,404.8$ pounds, or nearly 6 tons.

* * *

Question.—What would have to be the pressure upon the piston rod of a 6-inch pump in order to lift water 300 ft.?

Answer.—The 6-inch piston would have to support a column of water 300 ft. high, and, therefore, would be subject to a pressure of

$300 \times 12 \times .036 = 129.6$ lbs. sq. in.

Area of piston $= 28.2274$ sq. in.

Total load on piston and rod would be
$28.274 \times 129.6 = 3704.3$ pounds.

Question.—A floating drydock is 200 ft. wide and 600 ft. long. How deep would it sink under the weight of a steamer of 20,000 tons displacement?

Answer.—The dock would have to sink enough to displace 20,000 tons of water.

20,000 tons of water occupies $\dfrac{20{,}000 \times 2{,}000}{62.35}$

= 6415.39.7 cu. ft.

Area of dock $= 600 \times 200 = 120{,}000$.

Depth to which it would sink $= \dfrac{641{,}539.7}{120{,}000}$

= 5.34 ft.

* * *

Question.—The pressure in a water pipe before the water is turned on is 30 lb. per sq. in. Neglecting friction and other losses, how high should the water go if shot vertically upwards from a nozzle?

Answer. — Theoretically, the water should spout to the same height as would be required to produce the above as a hydrostatic pressure.

.036 lb. is produced by 1 inch of water.

30 lb. would be produced by

$\dfrac{30}{.036}$ in. or $\dfrac{30}{.036} \times \dfrac{1}{12} = 69.44$ feet.

which is the height to which the water would rise if no losses were incurred.

* * *

Question.—A hydraulic jack has a pump piston $\frac{3}{8}$ in. in diameter and a ram 2 in. in diameter. It is operated by a lever 22 in. long, pivoted at the end, and with the plunger attached 2 in. from the same end. With 50-lb. pressure on the end of the lever, how much could be lifted by the jack?

Answer.—The power arm of the lever is 22 inches and the work arm is 2 in. With a pressure of 50 lb. on the power arm the pressure on the small piston

would be $\dfrac{50 \times 22}{2} = 550$ lb.

The area of power piston = area of $\frac{3}{8}$-in. circle = .1104 sq. in.

Area of load piston = area of 2-in circle = 3.1416 sq. in.

550 lb. operating on every .1104 sq. in. of the 3.1416 sq. in. would give a lifting power of

$\dfrac{3.1416}{.1104} \times 550 = 15651.1$ pounds, or about 7.8 tons.

Question.—James Watt fed his boilers by raising the water tank high enough to cause the water to flow into the boiler by gravity. If the steam pressure were 60-lb. per sq. in., how high would he place his tank above the boiler?

Answer.—The height of water necessary to overcome 60-lb. boiler pressure would be

$\dfrac{60}{.036} \times \dfrac{1}{12} = 138.8$ feet.

* * *

Question.—If the atmospheric pressure be taken as 14.7 lb. per sq. in., how high would a theoretically prefect pump lift water?

Answer.—The water could be lifted high enough to balance its pressure against that of the atmosphere or

height $= \dfrac{14.7}{.036} \times \dfrac{1}{12} = 34.207$ feet.

* * *

Question. The steel hull of a ship weighs 7,400 tons. How much would it weigh at the bottom of the ocean?

Answer. Steel weighs 489.6 lbs. per cu. ft. No. of cu. ft. of steel

$\dfrac{7400}{489.6} \times 2000 = 3022.87$,

which is the volume of the water displaced. Weight of sea water displaced $= 3022.87 \times 64.085 = 193{,}720.62$ lbs.
7400 tons = 14,800,000 lbs. Actual weight of hull = 14,800,000 − 193,720.62 = 14,606,279.38 lbs. = 7,303.14 tons.

* * *

Question. — The side of a cast iron water tank is fastened at top and bottom. The tank is 8 by 12 by 9 feet high. When the tank is full what would be the strain (a) on top fastenings (b) on bottom bolts?

Answer. Formula, $P = \frac{1}{2} w h^2 \times$ length, or total pressure against one side
$= \frac{1}{2} \times 62.34 \times 9 \times 9 \times 12 = 30{,}297.24$ lbs.
It can be proved that this pressure may be considered to act at a point one-third of the distance from the bottom. Force acting against the bottom fastenings or tending to push bottom edge out would be

$\dfrac{2}{3} \times 30297.24 = 20198.16$ lb.

or 10,099 tons nearly. ....(b)

The force tending to strain bolts at the top is

$\dfrac{30297.24}{3} = 10099.08$ lbs.

or 5,049.54 tons nearly ....(a)

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AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery aod manufacturing interests, with special reference to machine tool improvement aud development, machine shop methods, devices aud systems relative to efficiency and economy of production.

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Vol. XI. JUNE 4, 1914 No. 23

PRINCIPAL CONTENTS.

THE COUNTRY PLANT.

THE policy of a number of large manufacturing firms, especially the older established institutions of the United States, in locating their Canadian plants in the country districts and small towns may be taken as a sign of the times. Some of the advantages of such situations are, of course, known only to the master minds of these industries and are the outcome of particular requirements: nevertheless, many of the country attractions are evident even to the casual layman.

The possibility of successfully locating in the country is limited, at present, to the larger institutions which can buy nearly all supplies in car or train load lots straight from the producers. Automobile transportation has made possible locations of small plants at considerable distances from large supply centres, but this in Ontario is again offset by the notoriously bad country roads. The man who has to buy his materials in retail lots must still be conveniently near his source of supply.

The labor problem which at first thought, looms large, has been successfully solved by the portable lumber mills of the West which go to the heart of the forests, as well as by some of the largest machine tool makers of the East. There are, no doubt, a number of high-class mechanics who prefer the comforts? of the metropolis to the freedom of the country or village life, but the reliability of the men who seek the quiet life forms a very strong counter attraction in the eyes of the employer. Then again, a large part of the manufacturing processes are being so changed by the introduction of automatic machines and methods as to require the physical and mental conditions incident to the life of the smaller centres of population rather than the product of strenuous city surroundings.

The cheap and wide circulation of both news and instructive literature, the formation of social and instructive societies and entertainments applicable to small units and the increasing available forms of transportation are rapidly putting intelligence and alertness in their proper place as an accompaniment of country life.

Let our newer industries follow the lead of the younger branches of the older firms and establish their factories in places where their future workmen can have homes of their own, a cleaner life and a chance to reduce the cost of living. Lower tax rates and more contented operatives will not be the only benefits the employer will derive from a business thus founded on humanity.

THE USE OF MULTIPLE DRILLS.

THE multiple spindle drill is one of the tools that has not been imposed upon by being intemperately used. In frequent trips of inspection through different plants one cannot but be struck by the lack of these labor-saving devices. Cases are common in crowded factories of from four to six single spindle machines being operated by one man drilling different holes in the same piece of work and moving it from one machine to another for each separate hole. If the six spindles were put on one machine, about three-fourths of the labor and floor space could be saved, the latter a most attractive feature where city land values must be figured.

We know of a plant where an elaborate fixture was provided for drilling eccentric straps. The operative, one day, set the job up between two radial drills which were situated close together and was able, in this way, to drill both holes at once. It was nearly a year before this firm decided to put an auxiliary spindle on the arm of one of the drills and thus confine the job to the one machine. This change alone almost cut the time in two for a large number of straight line jobs.

The system of making a multiple drill head for single spindle drills as a part of the drilling machine fixture for each job is bound to grow in popularity, and the method is greatly facilitated by the cheap production of accurate pinion stock and good universal joints. Let each tool room superintendent take a critical trip through his own shop and figure out how much could be saved by making his multiple jobs into single ones.

INDUSTRIAL NOTABILITIES--No. 37

LIEUT.-COLONEL JAMES W. WOODS, vice-president, Smart-Woods, Ltd., Ottawa; president, Blanket Mills, Renfrew; vice-president, Imperial Realty Co.; vice-president, Ottawa Uplands, Ltd.; vice-president, Elgin Realty Co., and president, Empire Cotton Mills, Ltd., was born at Kildare, Que., April 10, 1863, son of Russell Woods, a successful farmer and lumberman, whose ancestors were from Kildare, Ireland, and Anne J. (Davis) Woods, of Canadian parentage, she having been born at Longueuil, Montreal.

He was educated in private schools and at Montreal College, and at an early age entered the service of Rankin, Beatty & Co., Montreal; later serving with A. W. Ogilvie & Co. for three years. He next associated himself with Hodgson, Summer & Co., Montreal, representing them in Ottawa district for eight years. He established business on his own account in 1895, and by his personal effort and ability has built up the largest and most successful contractors' and lumbermen's supply house in Canada. This progressive concern, now known as Smart-Woods, Ltd., occupies a large factory, covering many acres, at Hull [illegible].

LIEUT.-COLONEL JAMES W. WOODS.

Besides constructing this plant, he is also the builder and owner of the Woods Building, now occupied by the Government, and housing the Military Department, also the Canadian Building adjoining same. Both of these splendid structures are of stone, and modern in every respect.

Mr. Woods is one of the most active and progressive manufacturers, and a most substantial public-spirited and patriotic citizen of the Dominion of Canada. He is a vice-president, Canadian Manufacturers' Association; vice-president, Ashbury College, Rockliffe, etc. He was president, Ottawa Board of Trade, 1907-1908; chairman of Citizens' Committee of Finance that raised a fund of $200,000 for the Y.M.C.A. of Ottawa, and one of the most active members of that body. He is Lieut.-Colonel of Governor-General's Foot Guards, and was elected an honorary member of the famous Guards Club, London, England, during 1909-1910, when attached to the Coldstream Guards. Lieut.-Col. Woods is permanent chairman of finance of the Earl Grey Musical and Dramatic Competition, which is held in various parts of the Dominion for the purpose of promoting the higher forms of musical and dramatic art, and is a great lover of art, having in his collection at Kildare House, Ottawa, examples of most of the Barbazon and Dutch schools of art, etc. He married Ida E. Edwards, daughter of John C. Edwards, Ottawa, on Oct. 18, 1893, and has three sons and two daughters.

His clubs are Ottawa Hunt, Rideau Country, Mount Royal (Montreal), Toronto (Toronto), Manitoba (Winnipeg), etc., and his residences are Ottawa, Ont., and "Kildare Lodge," St. Patrick, on the lower St. Lawrence.

Photo, International Press.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

	Montreal.	Toronto.
Grey Forge, Pittsburgh		$13 65
Lake Superior, charcoal, Chicago		16 00
Ferro Nickel pig iron (Soo)		25 00
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 75	18 10
Victoria, No. 2X.......	18 50	17 85
Victoria, No. 2 Plain ..	18 25	17 60

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh............	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh..........	1.15
Beams and angles, Pittsburgh....	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb. off
Nuts, Hexagon, all sizes..	4½ per lb. off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price per ft.	Extra Strong. Sizes Ins.	Extra Strong. Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 75	$15 75
Electrolytic copper	15 50	15 50
Casting copper	15 25	15 45
Spelter	5 25	5 25
Tin	34 50	35 00
Lead	4 85	5 25
Antimony	8 50	8 50
Aluminum	20 00	19 00

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double...	60%
Standard	60 & 10%
Cut leather lacing, No. 1	

BELTING RUBBER.

Standard	60%
Best grades	30%

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, $10\frac{3}{4}$ oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.24
Benzine, per gal	0.22
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough. Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., June 1, 1914.—There has been very little change in trade conditions this last week, and most firms report business as being much the same as during the last couple of months. So far as the machinery market is concerned there is very little "big" business passing, but smaller orders are coming quite freely. Slow collections are still prevalent, and most dealers claim that if it were not for this feature they could sell a lot of machinery. At present people are asking from six to nine months, and under these conditions dealers almost prefer to hold their stock until better terms can be arranged. There have been one or two fair-sized sales made during the past week.

Comparing the present situation with that of the last few years, one of the local men said to-day: "The years 1910-11-12 and the first part of 1913 were extra good from a business standpoint, and, as the population increased, everybody went ahead equipping their plants and factories in order to keep up with a growing demand. This, of course, resulted in a great outlay of money all round, and the banks, realizing the growth of population and general prosperity throughout the country, were quite willing to advance the needed capital. The result has been that we are at present equipped to supply a demand that is not half the actual output when all firms are running full time. It also means that most firms, being stocked up pretty well, have found it necessary to cut down their operations to about one-half, resulting in a large number of men being thrown temporarily out of work. The general attitude seems to be a waiting one, and it is hoped that this year's crop will be so close to record as to go a long way towards putting business on a better footing."

Metals.

The continued weakness in tin is practically the only feature of this market apart from the fact that business still continues quiet. This week there has been a further decline of ½ cent per pound in tin, and the same feeling remains, notwithstanding the decline.

Pig iron remains unchanged in price, as does the demand. Local dealers seem to think that pig iron is a very good buy at present figures. It would, however, be rather difficult to base one's requirements for the future owing to present conditions.

It is quite evident that stocks are none too heavy, and although there is very little buying going on at present, everything being done in a hand-to-mouth manner, the inquiries that are being received at present would lead one to believe that there will have to be considerable lead bought in the near future. Everybody is dickering for lower prices and buying small.

It is claimed by sellers that most of the foundries are running pretty low so far as stocks are concerned, but will not contract for any quantity until they have something to work on in the way of actual requirements.

Toronto, Ont., June 2, 1914.—Business conditions generally are still very quiet, but there is encouragement in the annual report of the Imperial Bank recently published. The president, in his review on trade conditions, exhibited a feeling of conservative optimism, calculated to strengthen the feeling of confidence which we believe is gradually becoming evident. From such an authority as Mr. D. R. Wilkie this optimism comes at an opportune moment, especially as his opinions are based on a thorough knowledge of conditions prevailing among the various industries of the Dominion. A return of trade to the previous high level must of necessity be slow, but it will be all the better if the improvement does come gradually and so allow for a natural adjustment to take place. Political affairs are still unsettled, which has a tendency to retard the growth of that spirit of confidence among business men, so much needed for the development of the country.

The national Town Planning Conference, which has been held here, under the auspices of the Conservation Commission, was productive of several interesting and instructive papers and discussions. Delegates from all over Canada and the United States and a number from Great Britain attended to give each other the benefit of their views. An interesting feature of the conference was the exhibition of drawings and photographs covering the various subjects discussed.

The iron and steel markets are in the same quiet condition as last week, no improvement has as yet become evident, although it is thought that soon there may be a change for the better. Prices remain at the same level and are likely to do so for some time. At a meeting of the American Iron and Steel Institute held recently in New York, the general opinion appeared to be that low prices would be seen through most if not all of the second half, the conditions apparently being too baffling to allow of the members giving any definite opinions, although a few spoke in a more or less optimistic vein.

The demand here for structural steel does not improve to any noticeable degree and the railways have not come into the market as yet for any considerable amount of material.

No change is to be noted in the pig iron market, prices remain on the same level and the demand does not seem to increase. It is reported from the United States that there has been considerable activity in basic iron in the Philadelphia and Chicago districts and a heavier de-

mand for foundry grades in some other centres.

Business in machine tools continues to keep in much the same condition. Dealers report that business is quiet: buyers apparently still holding off pending a return of better times. A local concern reports having sold a McDougal lathe and a Barnes drill press to the A. B. Ormsby Co. of this city.

The metal market is quiet, prices generally being unchanged. An improvement in business is, however, looked for in the near future.

Winnipeg, Man., May 30, 1914.—Few new machine shops have opened up lately, but quite a number of concerns are talking about building; these include a prominent bridge and ironworks in one of the western provinces. Inquiries for machine tools are coming in pretty freely. One city firm of machine tool brokers report having received inquiries for eight lathes.

Among the new concerns who are contemplating building is the Winnipeg Oven and Tool Co., with which is incorporated the Dominion Oven Co. and the Winnipeg Tool and Forging Co. They are figuring on erecting a plant at Elmwood, Man., for the manufacture of steam and hot air ovens, and to erect and install all equipment necessary for the use of bakers. The steam-heated oven is extensively used in bakeries and hotels throughout the British Isles, but is not so popular in this country. George W. Jones, Winnipeg, has invented a new type of oven, and together with Luther Holling, a well-known Winnipeg machinist, is going into the above business.

Besides bakers' supplies, they will also manufacture tools for blacksmiths, contractors and builders, and for the plumbing and steamfitting trades.

The demand for tool steel in the West continues fair, although no big orders are being placed. The impetus given to the oil business at Calgary and throughout the West is having some effect. Orders for tanks, etc., are being placed with local concerns, some of whom have been buying pneumatic tools for construction purposes. The rolling mills at Selkirk, Man., will not be in operation until next September in all probability.

A CANADIAN TRADE CAMPAIGN.

THE Canadian Chamber of Commerce in London, England, which has recently left its old quarters in the Royal Colonial Institute to share the building of the London Chamber, on Cannon Street, has just issued a circular in which an important proposal is made for "a Canadian trade campaign."

Admitting that some considerable time must elapse before the scheme of the British Manufacturers' Exhibition train can be successfully launched, the chairman (Hon. J. H. Turner) invites British merchants and manufacturers to consider the following proposals:—

That a Canadian trade fund be instituted, to which members shall be asked to subscribe from $50 to $125 each, according to the scope of the campaign and the number of firms participating. The fund to be utilized for a year's campaign on the undermentioned lines, the extent of its operations, of course, to be confined strictly by the total amount of the fund. As the trade campaign is to be conducted by the British manufacturers' section of the chamber for the benefit of their members only, the actual programme will depend upon the ultimate membership of the section and the trades most largely represented.

In order to prevent duplication of work and for mutual help and guidance, commissioners—though working independently—should not only keep in touch with each other, but should act under the advice and in consultation with C. Hamilton Wickes, his Majesty's Trade Commissioner in Canada.

MONTREAL LIGHT, HEAT AND POWER CO. REPORT.

SUBSTANTIAL gains in gross revenue and net earnings after operation and maintenance charges are shown in the thirteenth annual report of the Montreal Light, Heat and Power Co., published on May 26. Gross revenue amounted to $6,245,697, an increase of $736,141, or 13.4 per cent., while the balance of $3,467,246, after operation and maintenance, was $3,467,246, an increase of $286,130.

The new departure of deducting the depreciation and renewal reserve appropriation before fixed charges and dividends, instead of after, as formerly, makes necessary a readjustment of the various items of the profit and loss statement, after operation and maintenance, should any further comparisons be made. If the statement be thrown back into the old form it would show a balance, after charges, available for dividends, of $2,999,245, an increase of $282,131 over last year, and of $641,000 over the year before that. On this basis the company earned 17.6 per cent. on its $17,000,000 paid-up stock, against 15.9 in 1912-13 and 13.8 in 1911-12.

If the comparison be made the other way—that is, by deducting depreciation and renewal reserve appropriation before bringing down profits available for dividends in 1912-13 and 1911-12—then earnings on the stock were 14.1 per cent., against 12.7 the previous year, and 10.9 per cent. the year before that.

Whichever way the comparison be made, it is apparent that the company earned, roughly, between 1¼ and 1¾ per cent. more on its stock than it did in 1912-13. Six hundred thousand dollars was reserved for renewals and depreciation. The net surplus carried forward for the year was $689,268.

HANDS OFF MARINE RATES.

REPRESENTATIVES of the manufacturing and shipping interests strongly protested before the special railway committee on May 28 against the proposal of placing shipping rates under the jurisdiction of the Railway Commission.

J. E. Walsh spoke for the Canadian Manufacturers' Association, and emphasized particularly the competition of the United States boats. While conceding that control was desirable, he held that an investigation of conditions should be made.

W. R. Dunn, of the International Harvester Co., Hamilton, said that, if the legislation went through, the company would have to do away with its Hamilton terminals, since it would be driven off the water altogether. It would be cheaper for it to ship from its Chicago factory to the West once water competition was eliminated, as he predicted would result.

WESTERN CONDITIONS.

IN an interview given out at Montreal recently, Mr. J. S. Dennis, Assistant to the President and head of the Department of Natural Resources of the C.P.R., and reputed to be one of the most reliable authorities on western affairs, said: Business conditions on the railway as well as in the cities and towns are quiet at the present, but are beginning to show marked evidences of stimulation owing to the splendid spring weather and a consequent early movement of people to the western section of the Dominion. The abnormal growth of urban centres is credited with causing the depression of the past year, and the city development is now waiting for the necessary industrial and agricultural growth to catch up. When the two are more nearly on a level the prosperity of the past will begin to be appreciable again.

It is too early to speak of crop conditions, yet the spring indications are very encouraging and promise well for excellent returns. Immigration has dropped off to some extent, but this is only due to the holding back on the part of artisans and laborers. The numbers who are taking up land for the purpose of "sane" agricultural development or mixed farming are becoming larger each year.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Fort William, Ont.—Preliminary work has been started on the site where the Conley Switch Mfg. Co. will build their plant.

Weyburn, Sask.—The town council have decided to purchase a steam engine and generator. Tenders will be called shortly.

Vancouver, B. C.—The British Columbia Platinum Co. will start operations this month in the Tuluamen district.

Goderich, Ont.—The Water and Light Commission are considering the question of installing an electric-driven pump at a cost of $5,000.

Kingsville, Ont.—The Dominion Stove Co. will erect a plant to cost $12,000. J. C. Pennington, La-Belle Building, Windsor, Ont., is the architect.

Regina, Sask.—Two new stokers will be ordered at a cost of $6,900 from the Sandford-Riley Stoker Co., and installed in the new power house now being erected.

St. John, N.B.—The sawmill and machine shop owned by B. L. Moore was destroyed by fire recently, the loss being estimated at $8,000, a part only covered by insurance.

Medicine Hat, Alta.—The Pump and Brass Works are making considerable extensions to their plant, and adding to their stock of patterns and equipment. Geo. E. McDonnell is manager of the company.

The Kawneer Mfg. Co., of Toronto, Ont., has purchased a site covering seven acres at Guelph, Ont., where they will build a factory 40 x 500 feet for making art metal mouldings for store fronts, etc.

Sarnia, Ont.—It is reported that the H. Mueller Mfg. Co. have 154 men at work in their factory. They are rushed with orders, and are installing a number of new machines in their already well-equipped factory. They are so rushed with orders that the company are considering the advisability of working twenty-four hours a day.

Vancouver, B.C.—At a meeting of the city council of North Vancouver held last week it was announced that Fowler Bros. had taken over the Mainland Iron works, which would be moved across to the North Shore on property controlled by J. P. Fell. The industry will be greatly enlarged, the new development including a graving-dock and a shipbuilding and repairing plant. Work will be commenced at once.

Regina, Sask.—Negotiations for the erection of a large engineering plant at some point in Saskatchewan are under way at the present time by a Regina firm in co-operation with an American syndicate. A plant will be erected at a cost of about $50,000 to employ about 50 men. The company will manufacture gasoline and kerosene lighting lamps. Negotiations are being carried on between the local men and the Board of Trade at Kerrobert, who are offering a free site and have also guaranteed to finance the enterprise to the extent of $25,000, which will be subscribed by citizens of Kerrobert as capital stock.

Municipal

Stratford, Ont.—Tenders are being called for the construction of sewage disposal works.

Beaconsfield, Que.—The town will make extensions to its electric light plant, to cost $20,000.

Verdun, Que.—The town will make extensions to the waterworks and electric light plant this summer.

Vegreville, Alta.—It is proposed to make an extension to the municipal lighting plant, to cost $25,000.

Montreal, Que.—The Board of Control have suggested that the city should purchase twenty-three sprinkling wagons.

Berlin, Ont.—The board of health has reported that the city's water supply is not pure. A filtration plant will probably be installed.

Bridgeburg, Ont.—A by-law was carried on May 25 to spend $7,000 on good roads. Tenders have been called and awards will be made shortly.

Fort William, Ont.—Extensions will be made to the electric lighting system, and a new sub-station will be erected in the near future to cost $75,000.

Toronto, Ont.—Commissioner Wilson of the street cleaning department, is asking for two street cleaning machines. The estimated cost is $1,200 each.

South Vancouver, B.C.—The council proposes to spend $650,000 this year on permanent works, consisting of waterworks and sewage disposal system.

Winnipeg, Man.—The city will probably purchase two automobiles, 600 gallons capacity storage tank, and 15-water pressure gauges for the fire department.

Minnedosa, Man.—A by-law will be voted on by the ratepayers on June 5 to authorize the guarantee of bonds for $50,000 for the Minnedosa Power Company.

Woodstock, Ont.—The city council on May 26 gave the first reading to a by-law providing for the raising of debentures to the extent of $75,000 for a new city hall.

London, Ont.—The Board of Control have received tenders for a motor tractor for the fire department from the Knox Co., the La France Co., the White Motor Co., and the Seagraves Co.

Sherbrooke, Que.—Of the three by-laws voted on by the ratepayers, two were carried, these being the Hamilton Shoe Co. and Canadian Rand Co. by-laws. The C.P.R. by-law was defeated.

Kincardine, Ont.—The ratepayers, on June 25, will vote on a by-law to raise $3,500 in debentures for the purpose of changing the street lighting system of the town from the arc to the incandescent system.

Port Arthur, Ont.—It is proposed to construct a pumping station, disposal works, etc., at a total cost of $2,500,000 and to spend $550,000 for extensions to the waterworks system. These extensions include duplicate motor-driven pumps, etc.

Cranbrook, B.C.—It is proposed to increase the water supply by building a new reservoir and laying a steel pipe line to replace wood stave pipe. The estimated cost is $110,000, and a by-law will be submitted to the ratepayers on June 10.

Morris, Man.—On May 19 voting took place on the gas by-law, to sell the Morris Gas plant to the Acetylene Construction Co., of Montreal. The by-law carried by a vote of 45 to 0. The company will spend $500 in putting the plant in good order.

Port Arthur, Ont.—The extension to the waterworks system will be completed

about July 15. The work, which has been in progress about two years, represents an outlay of $550,000. The pumps have been supplied by Escher Wyss & Co., Montreal.

Redcliff, Alta.—Two by-laws voted on by the ratepayers on May 18, passed by substantial majorities. One by-law was for raising $75,000 for extending the waterworks system and the other was for raising $15,000 for installing additional street lights.

Eburne, B.C.—A by-law to authorize the Richmond Council to raise $40,000 for the extension of the municipal water service to the outlying districts is being prepared, and is expected to come before the council for consideration at the next regular meeting.

Galt, Ont.—The ratepayers of Galt on May 28 authorized a loan of $12,000 to the Maple Leaf Bedding Co., a by-law for this purpose receiving 558 votes in favor, and only 84 being polled against. The contractors will start at once on the erection of a building, and the firm expects to be ready to meet the demands of the fall trade.

Medicine Hat, Alta. The by-law providing for the raising of $70,000 for the construction of a traffic subway under the C.P.R. tracks at High street, was defeated on May 27, by a vote of 263 to 94. Lack of interest is assigned as the cause of the rejection of the measure the vote cast being only about 15 per cent. of the total registration.

Lulu Island, B.C.—Richmond voters will probably be asked by the council this month to approve of a $40,000 water extension by-law. The by-law is in course of preparation at present and will be considered at the next regular council meeting. Up to the present time, extensions to the water system have been made out of current revenue, the whole municipality thus sharing the cost. In the future, according to the council's plans, they will be made out of this by-law.

Chatham, Ont.—The industrial committee of the City Council is at present considering a novel offer that has been made by P. S. Coate, manager of the Chatham Gas Co., for the sale of gas and electric plants to the city. The matter will, in all probability, come up for final disposal at the meeting next Monday. The company plans to pay for their own plant by placing the profits from year to year in a separate fund and, when this has reached $300,000, hand over the properties to the corporation.

Berlin, Ont.—The light commission has received information from Petrolea that it will be impossible to provide this city with natural gas, as was predicted several weeks ago. Three new wells recently drilled have run dry and the fourth has only a small flow. The commission had placed an order for a large 350,000 ft. gas holder, but when information that natural gas would be available the order was held in abeyance. The commission will now probably proceed with the proposed extensions to the artificial gas plant, to cost about $60,000.

Regina, Sask. — A civic manufacturers' building is being advocated by the Industrial Commissioner as a solution of the problem which is confronted by small concerns starting in business in this city. The proposal is to erect the building and to lease it out in sections to new industries for a period of from one to five years, the rental to be sufficient to cover the interest on the city's investment. It is suggested that the new building might be built of reinforced concrete, six storeys high, at a cost of approximately $100,000 and covering an area of probably 50 by 100 feet. This would make provision for the construction of twelve sections, each 50 by 50 feet, to accommodate twelve small concerns during the period they are building up a business, and until such time as they are in a position to finance their own buildings.

Orillia, Ont.—At a special meeting of the town council held recently, the Water, Light and Power Commission requested the council to raise by debenture the sum of $85,000 for waterworks improvements and extensions. The council decided to submit the matter to the people who will vote on a by-law, on Thursday, June 18. An estimate of the proposed expenditure is made up as follows: 24-inch intake pipe, $2,500; dosing tank and pump-house, $13,000; pumping machinery and piping, $22,075; mechanical filtration plant, $22,800; extension gravity main for spring water, $400; new concrete roof on storage well, $400; 16-inch force main, pumphouse to corner Canice street, $3,475; two electric hydraulic valves at reservoir, $630; additional valves and boxes, $1,500; meters for commercial services, $1,500; a quantity of 4-inch, 6-inch, 8-inch, and 10-inch, cast iron pipe, $16,700.

Electrical

London, Ont.—The Keystone Mattress Co. are in the market for a number of electric motors.

Forest, Ont.—The new hydro-electric system which was installed at a cost of $31,000, is now in operation.

Regina, Sask.—An expenditure of $81,457 has been authorized for this year's extensions to the distributing system of the electric light plant. Wire, poles, insulators, transformers, etc., will be required.

London, Ont. — The Hydro-Electric Power Commission has decided to construct a power line to serve Strathroy from the Hamilton road transformer to Lambeth, Delaware, Mount Brydges and to its termination.

Winnipeg, Man.—Winnipeg Electric Railway Co. will supply electrical energy to the municipality of Fort Garry, a motion having carried at the meeting of the Fort Garry council, ratifying by-law 161, authorizing the contract entered into between Fort Garry council and the Winnipeg Electric Railway Co. The price to be paid by the municipality is $100 a month.

General Industrial

Beachville, Ont.—Wm. Neilson & Co., of Toronto, will build a condensing factory here.

Dutton, Ont.—The flour mill owned by William Hollingshead was badly damaged by fire on May 27.

Listowel, Ont.—J. C. Hay & Son's tile plant was damaged by fire on May 31, to the extent of about $5,600, half of this amount being covered by insurance.

Port Coquitlam, B.C.—By a majority of 86, the by-law authorizing the council to raise the sum of $100,000 for road improvements, was passed upon by the ratepayers recently.

Eyebrow, Sask.—The elevator of the Western Elevator Co., here was completely destroyed by fire on May 27. More than 15,000 bushels of grain were destroyed. The loss is estimated at $23,000.

Medicine Hat, Alta.—W. N. McNeely has confirmed reports that the Lake of the Woods Milling Co. had purchased the Medicine Hat Milling plant and business. The sum paid is in the neighborhood of $300,000.

Ingersoll, Ont. — Heavy damage was caused by fire at the City Flour Mills on May 24. The whole building was swept by the flames, and the damage has been estimated at $25,000, which belongs largely to machinery.

Grimsby, Ont.—The Grimsby Specialty Co., capitalized at $50,000, has taken over the business of the Silica Soap Co. of Vancouver, and will move the plant to Grimsby. The company will make various kinds of soap.

Amherstburg, Ont.—The Solvay Process Co., Syracuse, N.Y., will erect a large plant here for the manufacture of soda ash and kindred commodities. It has taken an option on several acres, part of which will be used for a manufacturing site.

High Bluff, Alta.—A. Forsythe & Co. have started to rebuild their elevator which was recently destroyed by fire. Excavation is already well under way. The new elevator will be considerably larger than the old one, and will be up to the full standard.

Strathroy, Ont.—Hamilton, Ont., capitalists have leased some 4,000 acres of land a few miles north of here, near the village of Adelaide, and will commence oil and gas drilling operations immediately. According to all indications, the field promises to be a good one.

Medicine Hat, Alta.—The contract for the erection of a million-dollar mill for the Maple Leaf Milling Co. has been awarded to Archibald of Winnipeg, who built the Kenora mill for the firm. Work will commence immediately. Mr. Archibald is already on the ground and expects to have the mill ready for grinding by the new year.

Fort William, Ont.—The N. M. Paterson Grain and Elevator Co. of this city have purchased thirteen grain elevators throughout Saskatchewan. The elevators purchased were formerly owned by the Royal Elevator Co. of Winnipeg. The new line of elevators purchased will be operated in conjunction with and provide feeders for, the terminal elevator in this city, owned and operated by the Paterson Co.

Medicine Hat, Alta.—The Ogilvie Milling Co. has purchased elevators at Irvine, Bow Island, Stirling, Warner, Magrath and Monarch, all in Alberta. The company will build one at Wilson's Siding, ten miles south of Lethbridge, and three on the Suffield branch of the C. P. R. These ten elevators will bring the Ogilvie Co.'s number up to twenty-seven, with a total storage capacity outside of the mill elevator here, of 825,000 bushels.

Brampton, Ont.—Three by-laws were carried on June 1 by the electorate. The Copeland-Chatterson Co. of Toronto asked for exemption of taxes for ten years in consideration of removing its office and staff to this town and adding to its factory here. Lindner's, Ltd., a jam factory operating in Toronto, and anxious to locate in Brampton, stipulated that the town should guarantee the company's bonds for $20,000. The Imperial Steel Co. also asked for and secured like consideration. The vote polled showed a good deal of interest on the part of the citizens.

Waterloo, Ont.—The Doering Trunk Co., Ltd., which was established here four years ago, and which has built up an extensive business, requires larger quarters. They propose to close an option on the former factory of the Wardell-Green Co., and will ask the town for a loan of $15,000 for fifteen years at debenture rate of interest and exemption from taxation for a period of ten years. The loan is to be repaid in fifteen equal annual instalments. The town as security is to obtain a first mortgage on the buildings, land and machinery. The company would employ from 50 to 75 hands.

Ottawa, Ont.—Work has commenced on the Government transfer elevator at Port Nelson. Plans for this elevator were made by the Canadian Stewart Co. The grain company has handed over to the Department of Railways and Canals the construction of the foundations and has the work now under way. It is thought that in so doing greater progress could be made. Part of the material necessary for the work was sent in last year, and the first boats for the bay this season will take in enough for the year's work. As soon as the foundations are completed, the grain company will arrange for the construction of the superstructure.

Brantford, Ont.—The United Rubber Manufacturing and Redeeming Co. will commence operations early in the fall, employing 100 hands. A contract has been let for the remodeling of the old Farmers' Binder Twine Co. factory adjacent to the Grand Trunk tracks on Sydenham Street. The contract was let to Bennett & Bowden, and work will be immediately proceeded with. The rubber company, which owns the factory building, will commence manufacturing and reclaiming rubber early in the fall. The factory site with excellent railway facilities is considered one of the best in the city.

Personal

E. G. Jackson has resigned his position as sales manager of the Canadian Car and Foundry Co., the Canadian Steel Foundries, Ltd., and the Pratt & Letchworth Co., to enter into business on his own account.

G. H. Flood, agent of the Department of Marine and Fisheries, has been appointed purchasing agent of the Department at Ottawa, in place of Cecil Doutre, and John C. Chesley, chief clerk in the assessors' office, has been appointed agent at St. John, in succession to Mr. Flood.

Trade Gossip

The Turbine Equipment Co., Ltd., Toronto, Ont., has been awarded a contract for a De Laval centrifugal pump by the City of Stratford, Ont. The pump will have a capacity of 1,000 gallons per minute against a head of 200 feet.

The Herbert Morris Crane and Hoist Co., Ltd., Toronto, have received an order, through their Vancouver agents, Messrs. Waddy & Young, for a 10-ton hand-operated overhead traveling crane, fitted with "Morris" roller bearings to the main traveling motion.

Saskatchewan Engineers.—Efforts are being made by several power plant superintendents in Saskatchewan to form a local branch at Regina of the American Institute of Electrical Engineers. No definite action in the matter has been taken up to the present time.

Canadian Vickers Drydock.—The Lady Grey, one of the Government icebreakers which has been in the Canadian Vickers drydock for some time, was floated again on May 25. She has had a number of damaged plates on her bottom and bow renewed, as well as being generally overhauled. The Vickers drydock since the opening of navigation has undocked the Murray Bay, which spent the winter in the dock; docked and repaired the Saturnia, J. H. Plummer, and Lady Grey.

Wood Working

Niagara Falls, Ont.—The Dominion Chair Co., Toronto, has secured a site and will erect a factory here. The plant and equipment will cost about $185,000.

Limoilou, Que.—The box factory of the Turner Lumber & Pulp Co. was recently destroyed by fire, with a loss estimated at $20,000. It will be rebuilt at once.

New Westminster, B.C.—Fire recently destroyed the lumber and shingle mill of the Royal Shingle & Lumber Co., near the Lulu Island bridge. The damage is estimated at $8,000, part of which is covered by insurance.

Vancouver, B.C.—A large shingle mill is being built at Farney Bay, Vancouver Island. It is reported that several mills are projected near Vancouver on account of the reduction in the tariff on this product entering the United States.

Refrigeration

Bird's Hill, Man.—The municipality of St. Paul contemplate erecting a cold storage plant for vegetables and similar produce.

ASSOCIATION AND PERSONAL

A Weekly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Machinery Circles

Personal

Frederic Nicolls, president of the Canadian General Electric Co., Ltd., was in Montreal recently attending the meeting of the Dominion Steel Corporation.

Victor Pezzini, representing the Victor Saw Co. of Springfield, Mass., and Hamilton, Ont., called on the Winnipeg trade last week, and proceeded west to the Coast.

F. F. Barber, who is in charge of the machine tool sales department of the Canadian Fairbanks-Morse Co., Toronto, was married on June 3 to Miss E. W. Walker, of Toronto.

G. B. Hunter, of the Tyne shipbuilding firm of Swan, Hunter, Wingham, Richardson & Co., arrived in Montreal on May 27, and will confer with Mr. Clarence De Sola, the Canadian director of the company.

C. L. Howse, of the Hamilton hydro system, has been appointed manager of public utilities for the city of Peterborough, Ont., at a salary of $2,400. Mr. Howse will have charge of the hydro system and waterworks.

Leonard Andrews, M.I.C.E., managing director of the Canadian British Engineering Co., Ltd., has taken over the management of the company's office in Winnipeg, Man., in succession to Mr. Reginald Porter, who has returned to London, England, to take charge of the office there.

Charles Herman, inventor of the pneumatic jarring molding machine that bears his name, died at his residence in Zelienople, Pa., aged 70 years. He also developed many other valuable patents known in the hardware and machinery trade. He was vice-president of the Herman Pneumatic Machine Company, Zelienople, and was born in Germany.

Charles G. Ritter, assistant superintendent of the Lunkenheimer Co., Cincinnati, Ohio, died at his residence in that city, May 23, after an illness of several months, aged 54 years. He had been with the company 22 years. In machine-tool circles he had an almost national reputation as a master tool maker. His brother Henry is superintendent of the Lunkenheimer Company.

D. H. Mapes, for the past two years connected with the C.P.R., but engaged for twenty-two years in building construction work, and formerly vice-president of the J. V. Schafer, Jr., Co., of New York City, one of the large construction firms on this continent, has been appointed superintendent of C.P.R. building construction. He succeeds F. L. Ellingwood, resigned.

W. Furniss Clarke, superintendent of Armstrong-Whitworth of Canada, Ltd., has returned to Montreal after paying a three months' visit to the various plants of the parent company in England, where he found business very good, if not quite so brisk as last year. Sir W. G. Armstrong-Whitworth & Co. in 1913 led the shipbuilding companies of the world with an output of 99,000 tons of all classes of boats. At present they have nineteen vessels on hand, six of these being battleships. Four of the latter are of the super-Dreadnought type. The Canadian plant at Longueuil, Que., is rapidly nearing completion, and is expected to go into operation at the beginning of August.

WHO'S WHO.

CAPTAIN W. J. PRESS,
Chief Mechanical Engineer, N.T.R., Ottawa, Ont.

Trade Gossip

The Schuchardt & Schutte Co. have moved their head office for Canada from Montreal to 42 Adelaide Street West, Toronto.

The Escher Wyss Co., Montreal, have been awarded the contract for one 1,400 h.p. water wheel, with governor, relief valve, blow-off valve and accessories, by the corporation of Revelstoke, B.C.

The British Columbia Manufacturers' Association in Vancouver, B.C., are calling upon the Burrard Inlet Tunnel and Bridge Co. to have all the steel for the proposed Second Narrows bridge fabricated locally.

The Turbine Equipment Co., Ltd., Toronto, have sold a 600-gallon per minute De Laval two-stage centrifugal pump, operating against a pressure of 100 lbs. to the Coniagas Reduction Co., St. Catharines, Ont.

The Jones Underfeed Stoker Co., Ltd., Toronto, have been awarded a contract by the Standard Underground Cable Co., Hamilton, Ont., for four stokers to be installed with two 250-h.p. "Heine" water tube boilers.

The Escher Wyss & Co., Montreal, has been awarded a contract for a 6,000 k.w. turbo generator, by the Commissioners of Edmonton, Alta. The turbine is of the "Zoelly" Impulse type, and the alternator of Siemens make.

The Escher Wyss Co., Montreal, has been awarded a contract for one steam turbine driven centrifugal pump of 200 h. p. capacity, 1,500 r.p.m. by the B.C. Government, through Frank Darling & Co., Vancouver, their agents in British Columbia.

The Turbine Equipment Co., Ltd., Toronto, has sold to the Union Carbide Co., Welland, Ont., the following equipment: One 1,500 gallons per minute De Laval single stage centrifugal pump to operate against a pressure of 100 lbs., also one 850 gallons per minute De Laval single stage centrifugal pump to operate against a pressure of 75 lbs. Both these pumps will be motor driven.

Hall Engineering Works.—After having a number of her bow-plates riveted and another propeller fixed to replace the one damaged in her trip to Montreal from England, the Manchester Inventor has again sailed. Five hundred tons of grain was placed in her bow in order to raise the stern sufficiently to take off the smashed propeller and replace it with another, an operation which the Hall Engineering Works successfully accomplished. The Harbor Commissioners' floating crane was used to lift the propellers,

each of which weighed over seven tons originally, though the broken one was but a fraction of this weight. The vessel was repaired at her shed, the men working right through to a finish.

Two Lighters Launched. — A unique launching was successfully carried out on Saturday, May 30, at the Polson Ironworks, Toronto, when two lighters for the Hudson Bay Terminal slid into the water. Both lighters were built on the same set of ways, and the launching occupied the small space of eight minutes. The christening ceremonies were performed by Miss Meta Gibson, daughter of the Lieutenant-Governor of Ontario. The launching was attended by a distinguished gathering, who after the ceremony were the guests of Col. J. B. Miller, the president and general manager of the company, at a buffet luncheon. Among those present were: The Lieutenant-Governor, Sir J. M. Gibson, Prof. Cohoe, Mr. Sydney Fellows, Captain J. B. Foote of the Toronto Vessel and Insurance Agency; Mr. A. E. Mathews, of the Mathews Steamship Company; Chief Engineer Bowden, of the Dominion Department of Railways and Canals; Mr. J. C. Stewart, etc.

Catalogues

Electric Drills.—The "Thor" electric drills are fully described in circular E-1, just off the press, which is being distributed by the Independent Pneumatic Tool Co., Chicago, Ill. The circular contains specifications of the various sizes arranged in tabular form, and illustrations of several types, stating the work for which they are best suited. This attractive and well-arranged circular will be mailed to interested readers on request.

The Merry Moulder.—The April number of the house organ of the Osborn Mfg. Co., Cleveland, O., is, as usual, a bright little publication, containing several humorous stories with a moral, the book at the same time being an effective advertising medium. Other matter includes descriptions of some of the products made by the comptny, with illustrations and a few suggestions for foundrymen. A leaflet is inclosed, rescribing the "Osborn" vanadium steel shovel.

The Terry Steam Turbine Co., Hartford, Conn., have compiled a novelty in the form of a "vacation chart," which, at this time of the year, when holidays are being planned, will be very useful to office managers. The chart is arranged for the months of May to October, inclusive, and will be of great assistance when arranging vacations for the various members of the office staff, as the dates can be seen at a glance. Copies will be gladly mailed to managers or superintendents who have charge of such arrangements.

Sprague Electric Hoists.—The Canadian General Electric Co., are distributing an attractive Catalogue No. 905, dealing with the "Sprague" electric hoists. The catalogue runs to 31 pages, each containing an illustration of some particular type of electric hoist with a brief description. The illustrations serve to show the varied conditions under which the hoists can be operated as the majority of them are of installations. The catalogue concludes with tables giving the ratings, capacities and weights of the various sizes.

Brushes.—The Munning-Loeb Co., of Matawan, N.J., have just issued Bulletin 500, descriptive of their line of plating and industrial brushes. The book contains information on brush manufacture from the making of the block, selection and origin of stock to the final finish. Operating characteristics of the several brush materials and their adaptability to certain classes of work are briefly described. This book, which is fully illustrated, will be found a handy guide to the buyer in selecting the best and proper brush. It will be sent by writing to the Munning-Loeb Co.

Turbine Pumps.—Canadian Allis-Chalmers, Ltd., Toronto, have just issued an exceptionally interesting bulletin, No. 2001, dealing with the Mather & Platt type of turbine pumps which they make. A feature of the bulletin is the description of the pump testing plant at Rockfield, Que. The methods adopted in conducting the tests and description of the plant are given in detail, accompanied by illustrations. A full description is given of the Mather & Platt pump with cross sections showing the principal features of the design, and exterior views of several types, including many illustrations. The concluding pages contain much useful data on pipe friction and several characteristic curves for high-lift pumps.

Book Reviews

Fires in Lake Superior Iron Mines, is the title of technical paper No. 59, published by the Bureau of Mines, Department of the Interior, Washington, D.C. The bulletin is edited by Edwin Higgins and deals with the mining methods of the Lake Superior ranges and fire prevention in those regions. The bulletin is also intended to awaken the operator to the ever-present danger of fire underground, and also gives a number of suggestions for fire-fighting appliances.

The Safety First Movement in the Industrial Sphere

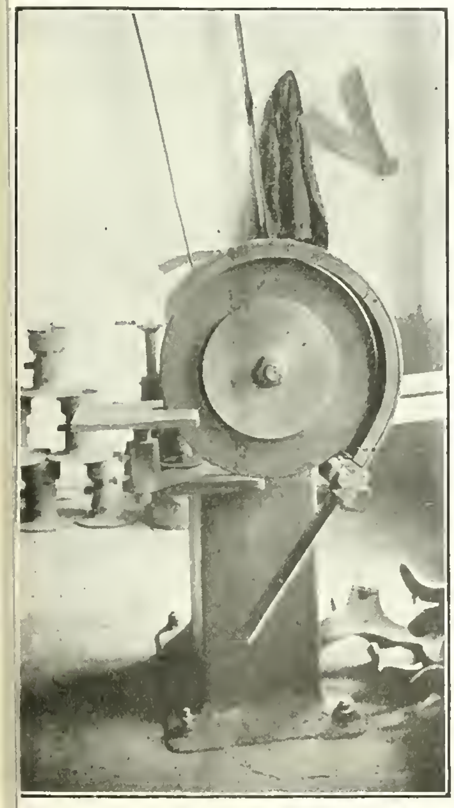
By Riley Schenck *

The effectiveness of the Safety First movement to achieve high degree results in our workshops and factories has been amply proved wherever practised and, due to its unrestricted application, no plant is too small and unimportant to come within its scope and derive the benefits accruing.

IN dealing with the subject of "Safety First" we must recognize that it is only a new adaptation of a very old principle. We have all been taught from childhood that self-preservation is the first law of nature, although, of course, many of us never took the lesson, and records show plainly that self is the least thought of element that enters into the alarming total of accidents in the industrial or community life. If all men thought more of themselves, there would not be so many who try to push a street car off the track with a motorcycle or auto, or who dispute the right-of-way with the "iron horse" in the railways. If men would think as much of others as they ought to think of themselves, we are sure that there would be far fewer accidents everywhere.

We are prone to talk about the speed of the age, and try to excuse our almost criminal carelessness, by the plea that we were in a hurry. The one lesson that "Safety First" impresses more deeply than any other is that it pays to make haste, slowly if necessary, but safely all the time. "Safety First" is awakened common sense; it is the applying of the old rule to your actions and thoughts in relation to others, as well as to yourself. In many of our large establishments more or less special thought is being given to the safety of employees. As a result, the employees are becoming aroused to the necessity of looking out for themselves and for the other fellow. A prominent United States manufacturer says: "The average individual at work for himself or in the pursuit of his own happiness will take more chances with his life and limb than are necessary for him to take in any employment, even as the state of protection stands to-day. There will be no change in this popular disregard for personal safety until there is an established public conviction, an active, yet sub-conscious state of mind, that automatically thinks of "Safety First."

*Canadian Safety Engineering Bureau, Toronto.

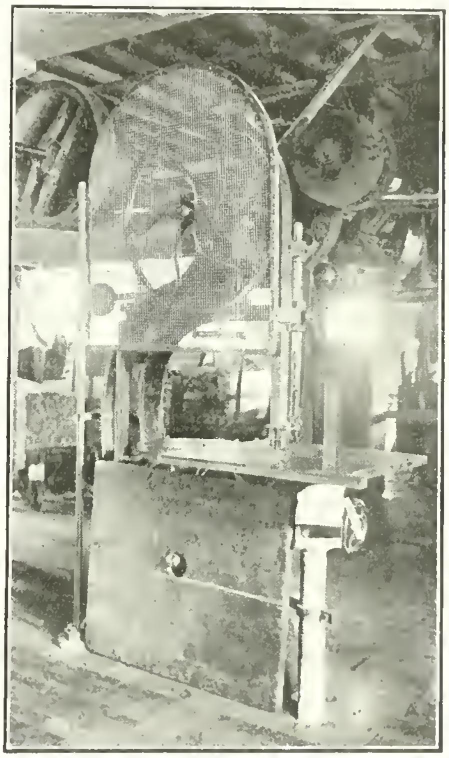


Emery Grinder with Taper Wheel, Safety Flanges and Band Type Guard.

No employer designedly exposes his employees, and on the other hand, it may be said that few workers purposely put themselves in harm's way. Years of education and sad experience have taught even the most heedless of men owning property that it pays to prevent fires. Such precautional measures with reference to fires are second nature to most people, and the same thought must be created on behalf of accident prevention. The same relation must exist in all minds, with reference to accidents, as exists with reference to contagious diseases. It may be the work of a generation or more to bring everyone to this state of mind.

"Safety First" education should commence from the cradle, be carried through the public schools, and then to the occupational field. All classes must be made to recognize its force from a standpoint of preventing human waste and effort. There will always be indifference, yet this may be largely overcome if the teachings are sufficiently impressive and started early enough in life. A "Safety First" campaign in any industrial plant, if properly carried out under the supervision of an expert in accident prevention, will positively reduce losses, under compensation, or any other system of insurance, and, while such campaigns are a new thing in industrial life, only dating back a few years, the records are undisputable. The following instances may be interesting:

Fred McKee, chief safety inspector of Fairbanks-Morse Co., Beloit, Wisconsin, states that the records of accidents for

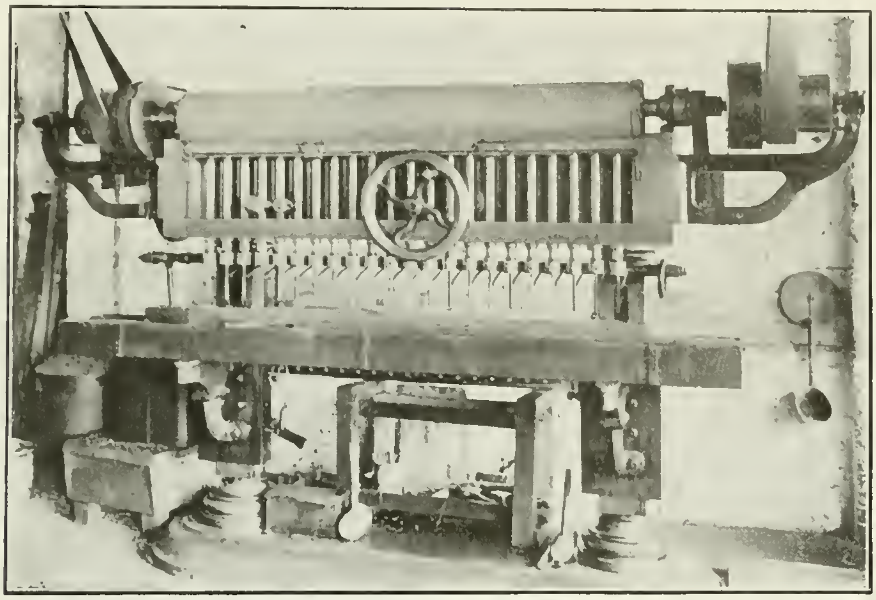


Band Saw with Wire Guard Over Top Wheel, Board Over Lower Wheel, and Tube Over Saw From Guide Up, Movable With Guide.

the year 1912, compared with 1906 shows a reduction in days lost on account of injury of 72 per cent. This company employs about 2,000 men. Mr. McKee estimates that 40 per cent. was saved by the installation of safeguards, 50 per cent. by education, organization and inspection, and 10 per cent. by improved shop conditions. Dr. F. D. Patterson, safety department of Harrison Bros., paint factories, Philadelphia, Pa., states that the reduction of accidents for 1913 over the previous year was 69.7 per cent. They employ about 900.

The Industrial Commission of Wisconsin reports a reduction of accidents of 26 per cent. for April, May, June and July, 1913, over corresponding months in 1912. The writer has records of reduction in plants in the United States running from 40 per cent. to as high as 95 per cent. in some special lines. The best information obtainable will justify the statement that in the United States in the last three years accidents have

been reduced on an average of about 42 per cent. in all industries, and that about 30 per cent. of this reduction is due to mechanical safeguards and 70 per cent. to inspection and education. In each case it is essential that the dangerous places should be looked up and properly protected, and plans must be devised to secure the co-operation of all classes of men to use the safety devices and practice safety principles.



22-Spindle Drill Press With Gears Guarded.

Accident Prevention in a Nutshell.

Accidents in several large industrial concerns in which the hazard is above the average have been reduced 66 per cent. through systematic effort.

Only one-third of this reduction has been accomplished by the use of mechanical guards.

The other two-thirds of the reduction has been accomplished by the following means:

Careful instruction, especially of new men, regarding danger.

Constant and rigid inspection by foremen and by committees of workmen.

Discipline of men who refuse to co-operate for safety.

Boost for safety meetings of foremen and workmen: this keeps up the interest and enthusiasm.

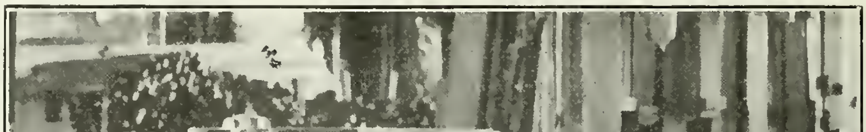
Make the workmen partners in safety work. Give them something to do and make them realize their responsibility: make them understand that a large percentage of accidents can be prevented only through their efforts.

Many large plants are now doing much work along accident prevention lines, with their own organizations, and many of the smaller ones would like to do the same, but are afraid that the expense will be too great. This is a mistaken idea. The services of an expert engineer for a few days to outline what steps should be taken, and how to take them; with a few instructions to your own repair men, or shop foremen, will enable any shop to go forward on its own.

There are reasons why an outside expert should be used. He has the special training to see the conditions as they relate to the laws and to his past experience in accident prevention; the places are not familiar to him from association, so that he is sure to note the danger points that those regularly employed will pass over from their very familiarity with them. A reliable expert can not only tell you what you ought to do, and how to do it, but he has on file what other factories have done, also the names and lines of those who are now making a speciality of manufacturing safety devices, etc.

A workmen's compensation law has been passed, and it is now the duty of every Canadian manufacturer in his line of business to do all he can to see that it has a fair trial, and if such a stand be taken it will be a great step in advance for Canada, and will result in good for all classes. It will engender harmony, efficiency, more and better work, and in the near future more profit for all.

The writer spent six months in the Massey-Harris plants, Toronto, promoting a "Safety First" movement. The results were very satisfactory, many hundreds of possible danger points being covered or removed, while improvements were made all along the line. This plant was in better shape than many that the writer has been in before and since, the superintendents of the various branches being capable and careful men, who had been doing everything possible to promote safe conditions. In spite of this, an outsider, with the experience and vision, found hundreds, yes, thousands, of previously unnoticed possible danger points, and the management was very quick to furnish the protection, as soon as shown where the danger was, or what to do to prevent it. The work is still going on, and there will always be



New Style Guards for Vertical Planer.

more to be done, for after a plant is fully covered, it is essential that a careful and persistent inspection should be kept up, daily if possible, but at least

Semi-Automatic Collapsible Elevator Gate Closed.

once a week, to see that everything is kept up to a standard.

It is just here, however, that most of the plants will fail. The foremen are busy and allow the matter to drop or become a little careless in following it up, and the men with that sixth sense that they seem to possess, "sense" the fact that the "old man" is not interested in "Safety First" any more. The guards will come off and be left off and dropped in the corner. An accident will happen, and the "old man" will storm around for awhile, blaming everyone, except himself, for the neglect, fix things up again and then forget. This is the very worst condition possible for a shop. It is the patient, persevering work along safety lines that counts. Education is what is wanted. Habits must be formed, and we all know that these are not formed at once. They are the slow growth from doing or seeing the same thing over and over again, and for that reason it is necessary to have a safety committee, composed of a high officer (the general manager or vice-president), the superintendent, one or two popular active foremen, at least two workmen and the safety inspector, making a committee of five or seven men.

We have found it very profitable to have three workmen upon the committee, and in many places a position on the committee is a reward of merit, for special interest shown along safety lines. The constitution may be changed frequently, leaving the workers on for one or two months only, and then appointing others; those who have served one term being recognized as advisory members afterward, and consulted now and then about safety matters. This is the best system that we have developed so far to get and hold the interest and co-operation of the rank and file of the shop employees, and where such a plan is not started, most of the work accomplished will go for naught, and the safety engineer be dubbed a failure; while all the time it is not his fault, but the shortsightedness of the management of the plant served.

"Safety First" in the shop is not only saving money in compensation saved, it is humanitarian work. It saves lives, prevents suffering, pain, sorrow, heartaches of wives and children, and loss of production as well; it means contentment, harmony, better feeling and, therefore, more efficient workmen. I quote a few paragraphs from a paper by G. L. Avery, Peoria, Ill., as to the effects of the Safety First and compensation systems when taken up intelligently by a large firm, and carried out systematically.

After giving in detail the mode of procedure, and the equipment of the first aid department, before and after April 1, and the results, Mr. Avery adds that no matter from what viewpoint we look we see the same results:

Personal interest means closer contact.

Under Belt Guard.

Closer contact brings quicker response.

Quicker response insures better care.

Better care secures more contentment.

More contentment produces better work.

Better work yields more profits.

Elevator Gate Open, Showing Clearance and Small Space Needed.

More safety means fewer accidents.

Fewer accidents result in less lost time.

Less lost time brings more steady work.

More steady work produces increased efficiency.

Increased efficiency assures greater output.

Greater output yields more profits.

It is our definite policy, because we believe the goodwill of our men is a valuable asset to the business, to have the men understand that we do not desire to hide behind any technicalities in the law, that we are giving them an absolutely square deal; that we are interested in keeping them sound and healthy, because we believe it is for their own good; and to this end we do nothing to antagonize our men; we have them sign no reports of their injuries which they might construe to mean that we are trying to avoid paying them compensation. After a serious injury, the employee is not allowed to return to the same job on which he was injured on account of the mental hazard in connection therewith. He is allowed to return to his regular work a little later if found advisable.

A record of six months' operation, from April to October, 1912, may be interesting, for several reasons. Employment is given to about 2,200 men.

Total examined, 2,179.

Injuries (every scratch is an injury), 618.

Ears cleaned, 128.

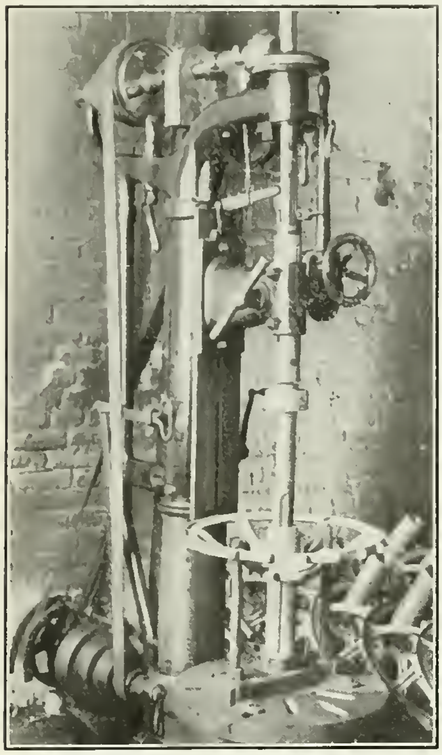
Later dressings, 1,772.

Minor treatments, 451.

Eye and ear tests, 47.

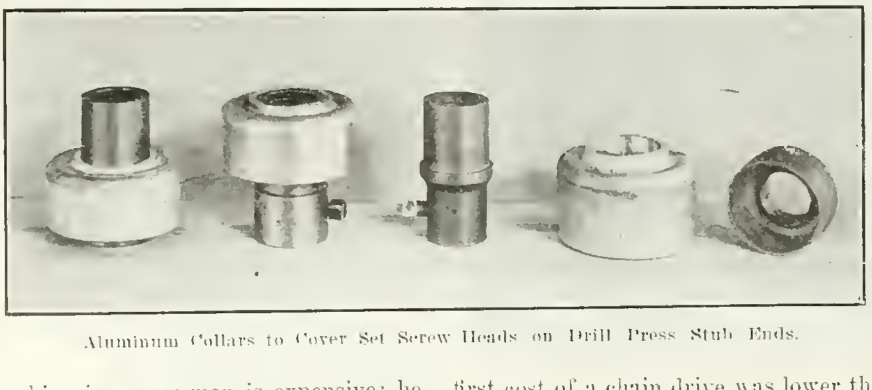
Reported, but no treatment, 135.
Doctor calls at employee's homes, 13.
Calls at doctor's office, 7.
Teeth and gums, 9.
Eyes treated, 205.
Operations, 18.
Fractures, 6.
Total, 5,592.

I believe that the Avery Company has gone into this matter on the broadest



Upright Drill Press Guarded.

and soundest plan of any that I am acquainted with. No plant is too small to be profited by a careful study of conditions and persistent efforts to reduce the hazards of accident or fire, for it will be harder for the small firm to meet the expenses from a fatal accident than the larger firm. With only a few men to be essential to the business, their places are harder to fill than in the large plant, where men can be transferred who are more or less familiar with the work.



Aluminum Collars to Cover Set Screw Heads on Drill Press Stub Ends.

Breaking in a new man is expensive; he will not produce as much for a few days, is more liable to spoil work, and is also more liable to be injured than the older men. The safety inspector of the Yale & Towne Co., Stamford, Conn., after a very logical deduction at one of the round table conferences of the Safety Engineers of America, said that even where a large percentage of unskilled labor is employed it costs considerable to break in a new man. He estimated that it cost the company he represented $10 for every new man.

The smaller plant will be at a disadvantage in starting "Safety First" campaigns, in that they cannot afford to have a special man to look after the work all the time, but they can still afford to have an expert a few hours once a month to inspect the premises and give the foreman the ideas necessary to keep the plant just as safe and up-to-date as the large manufacturer, who can afford to have safety engineers and inspectors and departments, as he desires to carry on the work.

The illustrations accompanying this article are from the Massey-Harris plant, Toronto.

SELECTION OF CHAIN GEARING.

A PAPER upon "The Selection of Chain Gearing" was read before the Birmingham and District Electric Club recently. The author stated that the chief factors affecting the question of chain gears were power, speed, gear ratio, the position of the drive, the distance between the shafts, and the direction of rotation. Much valuable information was included upon the design of chain drives, and convincing examples showing the savings in power and increased efficiency were given and illustrated by lantern slides. Notes upon the treatment of chains and the use of shock absorbers and fly-wheels were given. The importance of adequate lubricating arrangements and the advisability of gear cases where possible was emphasized, as affecting the life and satisfactory running of the chain. Figures were submitted showing that in many cases the first cost of a chain drive was lower than a belt or rope drive, while the life of a chain was invariably greater than the life of ropes or belts.

MOTOR CAR INDUSTRY IN CANADA

During the past twelve months Canada has imported over seven thousand motor cars from the United States, the total value of which was slightly over $9,000,000. Five year previous Canada bought only 385 cars from United States makers and their value came to $700,000 In 1913, which was far from one of the brightest commercial years, the records show an importation of 934 cars over the number for 1912.

There are between fifty and sixty thousand motor cars at present in the Dominion, and the average price runs between $1,500 and $1,700. This takes into account the preponderance in all sections of the Dominion, and for all purposes, of the low-priced cars, together with those of Canadian manufacture which are in the relatively high-priced class. Canadian manufacturers have never attempted, as yet, to dispute the sovereignty of the American car of $1,000 or under and have confined their efforts to makes of heavier and more elaborate design and power.

At a recent meeting of one of the leading Canadian companies, where the year's turn-over had not been particularly encouraging, an effort was made by certain shareholders to stampede the management into the cheap car field. The reply of those in charge was that the additional machinery for such a purpose would cost nearly $200,000 and the chances of successful competition would even then be distinctly uncertain. It is quite unlikely, therefore, that the standards or prices of Canadian cars will undergo any radical change in the near future.

The absence of the English-made automobile on the Canadian market continues to excite the wonder of foreign visitors. Under the Preferential Tariff, cars from the Old Country enjoy a reduction of duty from 35 to 22½ per cent., ad valorem. The importations, however, are almost negligible — something like two per cent.—in comparison with the annual sales of domestic and United States makes.

Motor trucks make a good deal of progress in the larger Canadian centres, particularly trucks of the heavy tonnage class. Retailers requiring a half-ton or quarter-ton maximum usually purchase a low-priced passenger car and use the chassis and engine as foundations for any special body they wish. While hundreds of auto deliveries may be noticed in the bigger centres, the contagion has been confined far within the predictions of a few years ago, and the horse still preponderates in the bulk of retail delivery. Electric pleasure cars of both Canadian and United States makes have upheld a steady sale in the cities, but are little used elsewhere.

The Effect of Electrical Engineering on Modern Industry *

By Charles P. Steinmetz **

In Section I. of the accompanying article, energy in chemical and electrical form is discussed and comparisons made, while in Section II. the part that distribution of materials and energy play in our civilization is treated also from the comparative achievement standpoint of chemical and electrical energy.

SECTION II.

Civilization results in the complete interdependence of all members of society upon each other. Amongst the savages each individual, family, or tribe is independent, and produces everything it requires. In the barbarian state some barter develops, followed by trade and commerce with increasing civilization; but up to a fair state of civilization —up to nearly a hundred years ago—all necessities of life were still produced in the immediate neighborhood of the consumer, each group or territory still independent in its existence, and commerce dealing with such things only which were not absolutely necessary for life. All this has now changed, and in our necessities of life, as well as in our luxuries, we depend on a supply from distances of hundreds and thousands of miles; the whole world contributes in the supply of our food, clothing, building materials, etc.

This means that our existence is dependent on an efficient and reliable system of transportation and distribution of all needs of civilized life. Such has been developed during the last century in the system of steam railroads, which, in taking care of the transportation and distribution of commodities, have made modern civilization possible. Civilization means separation of production, in time and in location, from consumption, to secure maximum economy.

Necessities of Civilized Life.

The necessities of civilized life consist of two groups: materials and energy. Our transportation system takes care of materials, but can not deal with the supply of energy, and the failure of an efficient energy supply has been and still is the most serious handicap which retards the advance of civilization. The transportation system could deal with the energy supply only in an indirect manner, by the supply of materials as carriers of energy, and when our railroads carry coal it is not the material which we need, but the energy which it carries. This energy is available, however, only to a very limited extent, as heat and as mechanical power in big steam units; therefore most of the energy demands of civilized life could not be satisfied by it.

In any country village far away from the centres of civilization we have no difficulty in having delivered material produced anywhere in the world; but even in the centres of civilization we could not get the energy to run a sewing machine or drive a fan without electric power. Thus, just as our steam railways and express companies take care of the transportation and distribution of materials, so civilization requires a system of transmission and distribution of energy, and our electric circuits are beginning to do this: and just as fifty to seventy-five years ago in the steam railroads, steamship lines, etc., the system of transportation and distribution of materials was developed, so we see all around us in the electric transmission systems the development of the system of the world's energy transmission in progress of development.

When we see local electric distribution systems combining, the big electric systems of our capital cities reaching out over the country, transmission lines interconnecting to networks covering many thousands of square miles, this is not merely the result of the higher economy of co-operation, of mass production, but it is the same process which took place in the steam railroad world some time ago, as a necessary requirement of co-ordination to carry out their function as carriers and distributers of materials in the case of the railroads, of energy in the case of the electric systems.

We must realize this progress, and the forces which lead to it, so as to understand what is going on, and to assist in the proper development, in avoiding, in the creation of the country's electrical network, whatever mistakes have been made in the development of the country's railway network.

Electricity, then, is taking over the energy supply required by civilization as the only form of energy which, by its simplicity and economy of conversion, combined with economical transmission, is capable of supplying all the energy demands, from the smallest domestic need to the biggest powers. As we now begin to realize, the economic function of the steam engine is not the energy supply at the place of consumption, from the chemical energy of coal—it is too complicated and inefficient for this—but it is the conversion of chemical energy of coal into electrical energy in bulk, for transmission and distribution to the places of consumption.

Electrical Power and Industrial Methods.

If, then, electric power takes the place of steam power in our industries, etc., it is not merely the substitution of the electric motor for the steam engine or turbine. Such would rarely realize the best economy. The method of operation in all our industries, and especially those requiring considerable power, is largely more than usually realized determined by the characteristics of the power supply, and what is the most economical method with the steam engine as source of power may be very uneconomical with electric power supply, and electric power supply often permits a far more economical method of operation than was possible with steam power. Thus the introduction of electricity as the medium of distributing the world's energy demand means a reorganization of our industrial methods, to adapt the same to the new form of power.

For instance, the steam engine requires skilled attendance, and with its boiler plant, auxiliaries, etc., is a complex apparatus, and is economical only in large units. Thus, when operating a factory or mill by steam power, one large engine is used, driving by shafts and counter-shafts, by pulleys and belts, and possibly wasting half or more of its energy in the mechanical transmission to the driven machines. We could not, however, economically place a steam engine at every one of the hundreds of machines in the factory. Substituting electrical power by replacing the engine by one large electric motor would be very uneconomical, as we can place a motor at every driven machine, and these small motors are practically as efficient within very few per cent. as one big motor would be, and all the belting and shafting, with its waste of energy, inconvenience, and danger, vanishes.

With the steam engine as source of power, to run one or two machines only, to complete some work, it means keeping the big engine in operation, and therefore contributing to waste. With individual electric motors the economy is practically the same whether only one or two motors are used, or the entire factory is in operation. On the other hand, with the steam engine, it makes no difference in the cost of power whether it is in operation from 8 a.m. to

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**Chief Consulting Engineers, General Electric Co.

6 p.m. or from 6 a.m. to 4 p.m. With electric power, in the former case the power demand would overlap with whatever lighting load the same supply circuit carries, but would not in the latter case, and the latter case thus would give a better load factor of the electric circuit, and thereby a lower cost of power. Again, with electric power, if very large power demands could be restricted to the period of light load on the electric supply systems, this would reduce the cost of power. Nothing like this exists with the steam engine.

Electrical energy thus makes the power users economically more dependent upon each other, and thereby exerts a strong force toward industrial co-ordination—that is, co-operation.

The Traction Problem.

Another illustration of the industrial reorganization required to derive the full benefit of electric power is afforded by the traction problem. Very often a study of the electrification of a railway shows no economical advantage in the replacement of the steam locomotive by the electric locomotive, even when considering only passenger service. At the same time, an electric railway may parallel the same steam railway, offer better service at lower price, and show financially better returns than the steam railway. In the early days of steam, the steam engine in place of the horse in front of the stage coach was no success, and still the stage coach has gone and the steam locomotive has conquered; but it did not by replacing the horse, but by developing a system suited to the characteristics of the steam engine. The same repeats now in the relation of steam traction and electric traction.

The steam engine is most economical in the largest units, and the economy of steam railway operation depends on the concentration of the load in as few and as large units as possible: therefore, the largest locomotive which can pass through bridges and around curves. Exactly the reverse is the condition of economy of electric traction: the economy depends on the distribution of the load as uniformly as possible in space and in time—that is, small units at frequent intervals—and therefore, while steam traction has gone to larger and larger units, in electric traction even the trailer car, so frequently used in the early days, has practically vanished.

Obviously, then, the electric motor can not economically compete with the steam engine under the conditions of maximum economy of steam and minimum economy of electric operation, and electric traction under steam traction conditions shows marked economy only in the case of such heavy service that the maximum permissible train units follow each other at the shortest possible intervals—that is, give maximum uniformity of load and thus the economic requirements of both forms of power coincide. These two instances may illustrate the changes in industrial operation which the introduction of electric power requires and which are taking place to-day.

TRUING WHEELS FOR RAPID AND ACCURATE GRINDING.

By Charles H. Norton.

When considering the question of truing grinding wheels, one should not become confused with dressing grinding wheels, because the dressing of a grinding wheel is altogether a different matter. Dressing is done to rough up a grinding wheel as well as to true off the high points and make the wheel approximately concentric, but truing a wheel as understood by users of wheels for grinding cylindrical and accurate surface work is not roughing the wheel, but making it very accurate as to concentricity and surface. Even this class of truing may be divided again into two kinds, one for sharpening the wheel as well as for making it perfectly true, and the other for dulling the wheel while making it perfectly true—that is, putting a very smooth surface upon the wheel.

Accurate truing, which is not dressing is accomplished with a diamond, and this diamond should always be held in a fixed tool post, never in the hand. There should always be a liberal supply of lubricant or water flowing on the diamond while the truing is being done. Allowing the water to be on the diamond part of the time and off part of the time is very bad for the diamond, and also it prevents the operator from securing a perfectly smooth wheel face.

With modern cylindrical grinding and modern surface grinding a relatively coarse wheel is used for removing the greater part of the material that is to be removed, a wheel so coarse that its grain will not allow, when cutting freely, of a finish fine enough. We, therefore, after removing the material, require just before finishing to true the face of the wheel with a diamond that does not have a very sharp point, but preferably has a small rounded, or perhaps considerably rounded, point. Then by very slow passing of the diamond over the face of the wheel when the diamond is held in a fixed tool post, we create a surface on the wheel which is smooth, and at the same time perfectly true. The surface is a temporary one on this otherwise coarse wheel, but by careful application of the wheel to the work, not to disturb its surface, we secure a finish on the work. In other words, the quality of the finish on the work depends upon the quality of the surface on the wheel.

When a second piece is to be ground roughly, a relatively deep cut is taken by the wheel; this smooth surface disappears, and we have the coarse wheel in action again.

Many times it is necessary to true a grinding wheel perfectly because chatters have occurred in the work, due to uneven wear of the wheel or vibration of the work itself. Careful re-truing and smoothing the face will secure accurate ground work always, if this truing and smoothing is done carefully.

Some people still use for cylindrical grinding wheels that are fine and dense. These people require a diamond with a sharp point in order that they may somewhat rough up the surface of the otherwise too smooth a wheel. In this case, as in the other, water must flow on the diamond all of the time when it is cutting, but instead of very slow passes across the wheel, a few more rapid passes are required for this class of truing; but in no case for accurate work should one presume to use a so-called wheel dresser. It is impossible by its use to do cylindrical grinding that is any way accurate. For accurate cylindrical work the most profitable wheel to use is one that requires frequent truing. It is a mistaken idea that many have, that truing a wheel is lost time and expensive.

In other forms of grinding of a less accurate nature, the so-called wheel dresser is used to advantage. Even there it should be held in some kind of a guide or tool post to secure as true a wheel as possible, although the cutters of the wheel dresser are roughing the surface to give the wheel a more rapid cutting surface. It would probably be more profitable that a wheel soft enough to keep free cutting without the use of a dresser could be used, were it not for the fact that many workmen become careless and break into a soft wheel, causing it to run out of true quickly and to be wasted. Therefore, a somewhat harder wheel is used, requiring in some cases dressing to increase the production.

The popular idea of a diamond for truing a wheel is that it should always have a sharp corner in order to cut sharply on the wheel, and make the wheel face perfectly sharp. This idea is so prevalent that it has been suggested by one writer that the diamond be revolved while truing the wheel. After thirty years experience with grinding, the writer believes that the most useful diamond is the one that does not have a sharp corner, and the most useful wheel is one that is sufficiently soft and coarse that when trued it is made more dull than if not trued, for the reasons given above.—Grits and Grinds.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

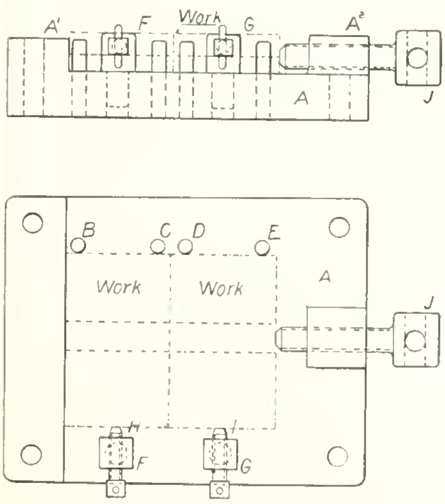
FIXTURE FOR MACHINING SMALL SLIDES.

By W. G.

THE drawings herewith illustrate an accurate and inexpensive method of machining small machine slides, and will, if reasonable care be exercised, produce work of first-class finish, thus eliminating to a certain extent, the tedious operation of scraping. With reference to the accompanying cuts, Figs 1 and 2 are elevation and plan of the fixture for the first and third operations. Figs. 3, 4 and 5 are front, side elevation and plan of the swivel fixture for the second operation, i.e., milling slide faces.

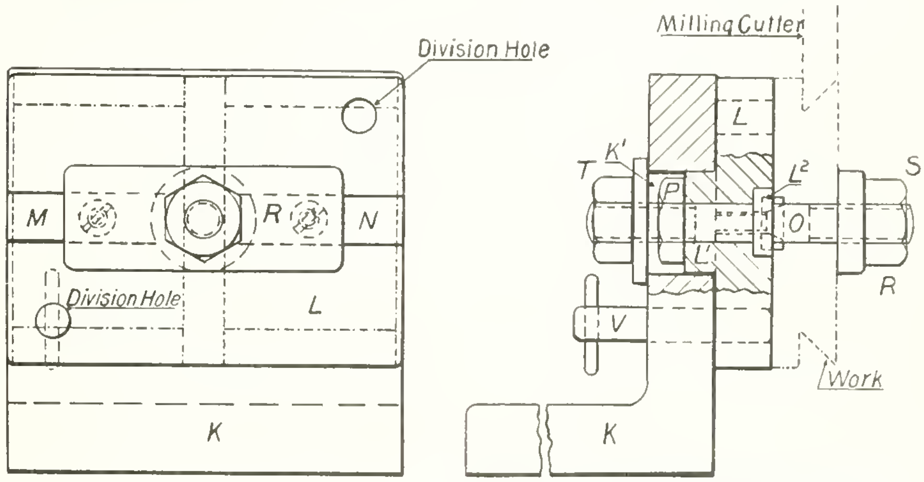
With reference to the fixture for the first operation Figs. 1 and 2, the body A consists of a rectangular iron casting provided at its extreme ends with two projections A' and A². The former serves the purpose of a stop and the latter for carrying the clamping screw. The locating pegs B, C, D, and E, are made from silver steel and should be a tight fit for the holes in the body. The square blocks F and G carrying the set-pins H and I are provided with turned ends as shown. These also should be driven tightly into the base. Part J is the clamping pin. This is made from mild steel and should be casehardened at the end in order to prevent "burring." The four corner holes are for securing the fixture to the machine table.

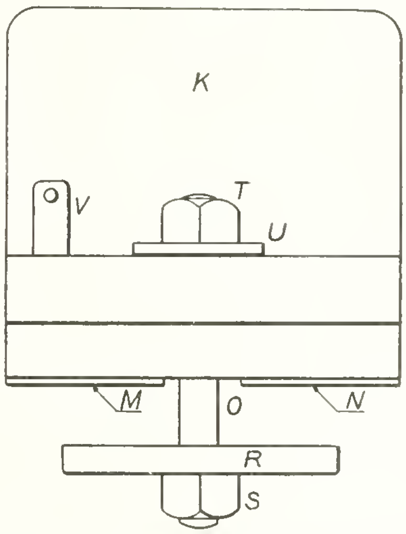
The second operation fixture Figs. 3, 4 and 5—machining slide faces—is made to swivel, the object of this being to provide means for machining both slide



Figs. 1 and 2. Elevation and Plan of Fixture for First and Third Operation.

faces of the work at the one setting of the fixture. The body K consists of a cast iron angle bracket having a central hole K'. Its purpose is to provide location for the swivel plate L, which consists of a rectangular cast iron plate provid-





Figs. 3, 4, 5 Front, Side Elevation and Plan of Swivel Fixture for Second Operation

ed at its inner face with a circular projection or spigot L'. On its opposite face is a longitudinal grove L² for receiving the locating strips M and N; these being secured to the swivel plate by means of the countersunk screws as shown.

The part O or clamping pin should be a tight fit in the swivel plate L and is finally secured in position by means of the lock nut P. The clamping strap R is made of mild steel and need not be machined beyond drilling the pin hole. Parts S, T, U, are the clamping nuts and washer respectively. The dividing plug V is casehardened mild steel suitably ground and should be a good sliding fit in the holes.

The sequence of operations is as follows:—The components, shown dotted, are first set in position on the swivel plate L. They are located by the blocks M and N engaging with the rectangular tongue slots formed on the under side of the components. The work is finally secured by means of the clamping strap R and the nut S. After the first side has been machined, the fixture is reversed in order to machine the opposite side of the component, this being performed by withdrawing the plug V and giving the swivel plate a half turn. This brings the opposite division hole into alignment with that in the body K. The plug is again passed into position, the clamping nut T tightened, and the component is thus prepared for the second machining process.

The first operation fixture Figs 1 and 2 is also used for the third operation—that of machining top surface the only difference being that the work does not require to be located as in the first operation. This is accomplished by machining the tongue slot in the previous setting. Lateral location is quite unnecessary as the work is purely one of plain surface milling.

DRILL JIG AND GAUGING FIXTURE FOR ADDING MACHINE SHAFT.

By H. Burg.

In this article are shown two tools consisting of a drill and locating jig and gauging fixture for one of the operating shafts of an adding machine, to which are attached several arms or operating levers for various mechanisms. The assembled part is shown at Fig. 1, and consists of the shaft, A, to which are attached the several levers, B, C, D and E, to which are staked to hubs F, which

in turn fit the shaft and are fastened thereto by means of pins G. The holes through the hubs and shaft for these

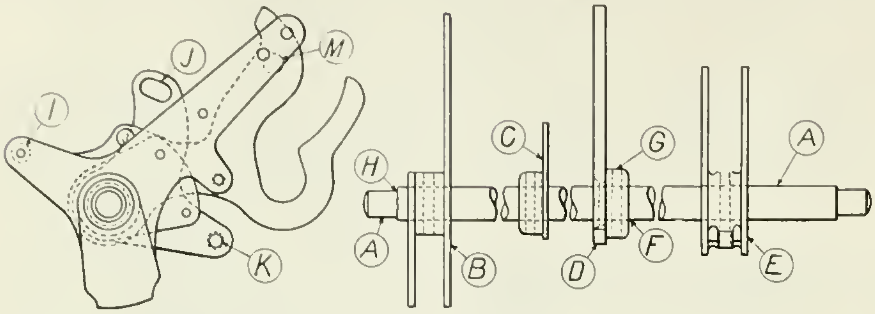


Fig. 1. Drill Jig and Gauging Fixture for Adding Machine.

pins are located and drilled in the jig, Fig. 2, which has some interesting features.

On a boss on the body casting, 1, is located a block 20 on one end, against which the shouldered end 11 of the shaft A bears. There are also four blocks, three of which support the shaft in the jig. The shaft is clamped down in the jig by means of two clamps, 4, and thumb screws, 5. The fulcrums for the clamps are the shouldered screws, 6, which have springs around them to support these clamps and prevent them from falling down when the work is removed. They are also provided with elongated slots in which the screws, 6, are a sliding fit, so that, when the drilling is finished, the clamps can be drawn forward out of the way.

The hinged leaf, 7, is an iron casting which swings on two pins, 8, and is clamped down by means of the thumb-screw, 9. This leaf carries the hardened drill bushings and is released by a quarter turn of the thumb-screw, so that it can be raised when removing or placing the work.

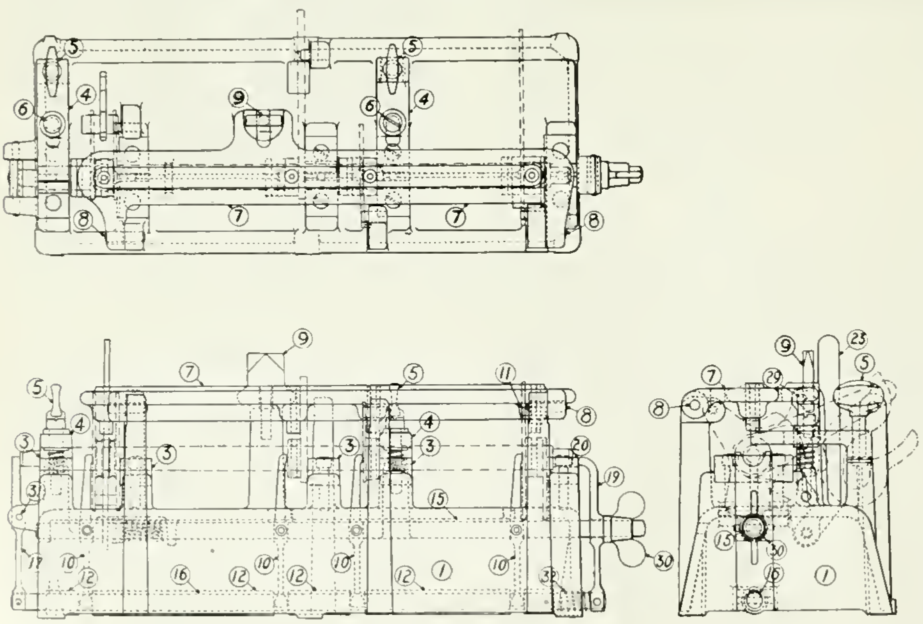


Fig. 2. Drill Jig and Gauging Fixture for Adding Machine.

The arms to be attached to the shaft are located in position in the jig in the following way: The hubs to which the arms are attached are pressed against the various blocks 3 by the yokes 10, which gives them the proper lengthwise positions. Arm B is located relative to the axis of the shaft by the hole I, and the pin 11. Arms C and D are set in the jig by holes and pins in the same way. The arm E is located by the slot J and a flat eccentric lever shown in the left hand end of the elevation, Fig. 3, which engages the arm by means of the pin K, Fig. 1. The pin K is pressed down so that the locating pin which fits J always rests in the end of the slot.

The means of clamping the work in the jig are very ingenious; first vertically by means of clamps, 4, already described, and horizontally by means of two shafts, 15 and 16, which pass through the body casting from end to end. To the upper shaft, No. 15, are fastened a number of reverse yokes, 10, the fulcrums of which are at the bottom of the jig. The ends are slotted to straddle the shaft, 16, and bear against the ends of a number of loosely-fitting sleeves, 12.

The sleeves do not move, but the shaft moves freely through them. When the thumb nut, 30, is tightened, it draws shaft, 15, to the right, and the levers press against the hubs, F, thus holding the various arms against the locating blocks.

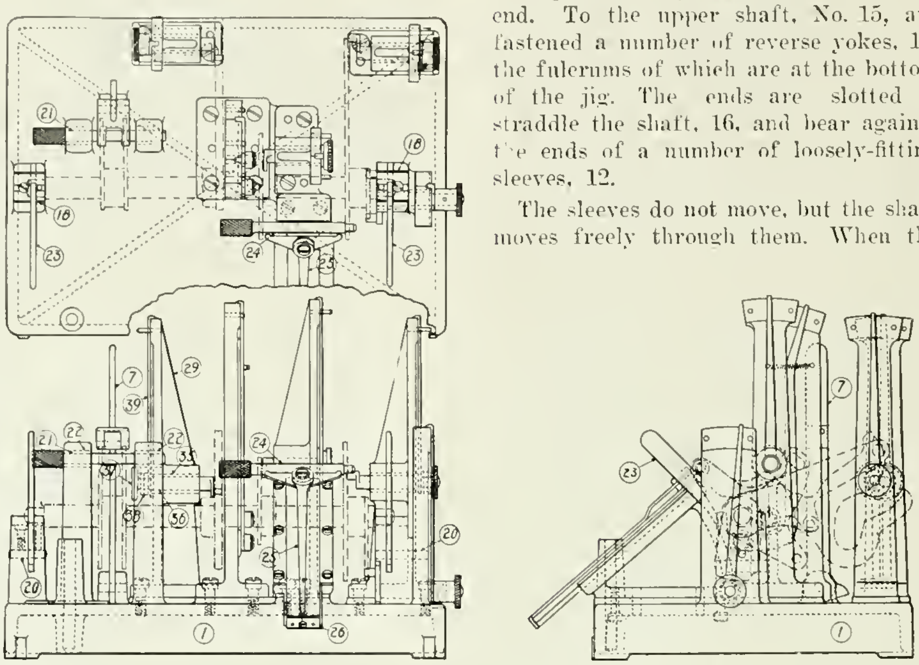


Fig. 3. Drill Jig and Gauging Fixture for Adding Machine.

The end of the shaft being drilled is likewise engaged by a lever 17, having its fulcrum in a boss on the end of the jig body, and swinging on pin, 31. As the shaft, 15, is drawn to the right by tightening the thumb nut, the shaft, 16, is moved to the left by lever, 19, thus causing lever, 17, to press against the end of the work. When the drilling is finished, springs, 32, return the clamp lever to the open position, when the thumb nut is loosened.

For gauging the assembled mechanism, the gauge or testing fixture, Fig. 3, is employed. On each end of the base casting, 1, is a hardened block, 18, on which the shaft lies. The shaft is clamped and held down against the V's by means of the two swinging levers, 23, which are pivoted on pins, 20. The work is also held in the gauge and kept from turning by the pin, 21, engaging in the parallel

slot J in arms E. The removable pin, 21, fits into bushings, 22, in the bosses shown. The pin is made to bear at the end of the slot by the arms E being pressed down against the pin by the swinging lever, 7.

The function of the gauge is to test the position of the various arms in relation to the shaft arm and to the arms, E, and with relation to each other.

The arms B and C have holes, I, parallel, and this relation must be maintained. To gauge this, a pin, 24, is passed through the holes, and bears against the indicator arm, 25, by means of which any variation is shown on the graduated end of plate, 26, which holds the indicator arm.

The indicator arms are gauged by indicator devices which are quite similar in principle. The parts making up the one for the hole M in arm D are shown in detil for clearneess. A cast iron bracket, 29, is screwed to the base casting and this bracket contains a bushing, 35, in which the gauge plug, 36, is a sliding fit. The gauge plug has a knurled plug, 37, fastened to it by means of pin, 38, and to the head is fastened by a pin the indicator arm, 39. The end of the plug, 36, is made to fit the hole M. When the work is in place in the gauge, the end of the plug is placed in the hole. If the arm is in the correct position, the indicator arm will register at zero on top of the bracket, and the other gauge plugs for the various arms being engaged with the work, all the indicator arms should register zero also, if the work is correct, and if not the variation may be read off by the graduations on the supporting brackets, thus making known the exact amount of the error.

Practical Methods of Laying Out Gear Teeth

By John Edgar

The ability to design the correct forms of gear teeth is now but little required of mechanics in general, the necessary knowledge being limited to that required to operate machines for the purpose. A knowledge of fundamental principles, however, if seen in a practical light and properly understood, will give one a conception of the requirements of gearing that is useful, if not essential to the correct application of gears to their various uses.

WHEN we consider the number of gears used at the present time, it may be safely said that no other piece of mechanism is so little understood by the average man of the shop. This lack of knowledge is partly due to the mechanical means at hand to form the teeth and the mystery that ever surrounds the subject in its theoretical form.

A simple treatment can be made of the subject that will give a clear in-

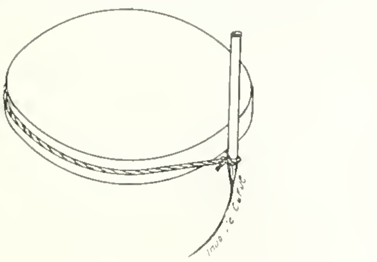


Fig. 1. Laying Out Gear Teeth.

sight into the method of obtaining the tooth forms so that they may be drawn on the board as easily as they are cut in the machine. In this article it will be necessary to consider the involute form of tooth, as it is to-day the only form that is in use the world over, and in dealing with it we will set forth some simple methods of constructing the true curve as well as easy ways of drawing practical approximations that will be even more useful.

The Involute Curve.

The involute is the curve described by a point on a non-stretchable cord as it is unwound from a disk. The top of a round can or a round box and a piece of fine strong string with a pencil suitably attached can be used for this purpose as shown in Fig. 1.

The geometrical method by which the curve may be drawn is shown in Fig. 2. Draw from O as a centre a circle which is to be the base of the curve or the circle from which the involute springs. Divide off on this circle a number of equal spaces a, b, c, d, etc., and draw tangents to these points on the circle. This can be done by drawing radial lines from the centre through the above points and then drawing the tangents at right angles to these radii. Now on the tangent at a, mark-off from the point of tangency a, a space equal to one space already laid off on the circle. Likewise on the tangent at b measure off two spaces and continue to lay off on successive tangents a number of spaces equal to the distance in spaces from the starting point on the circle. This done, a curve connecting the last points on the tangents will be the involute with the circle as a base. The curvature of the involute will depend on the diameter of this circle and all involutes drawn from any given circle as a base will be alike.

The involute curve is adaptable to the needs of tooth gearing in that two opposite involutes to any circle as a

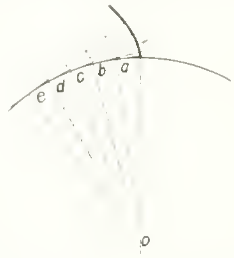


Fig. 2. Laying Out Gear Teeth.

base will roll together on one another with uniform motion as in Fig. 3. The direction of the contact pressure is at right angles to the curves and lies along a line tangent to both base circles of the involutes in mesh.

The point of contact of a single pair of teeth moves along the lane a a, Fig. 3, as the gears revolve and the angle at which this line stands depends upon the distance between the centres of the base circles being greater as this distance increases. For a given angle of this line of contact the centres of the base circles are at a relative distance which cannot be altered so long as this angle remains the same. In gear tooth language, this line of contact is called the pressure line and its direction is along the line of the pressure between the teeth.

The curvature of the involute decreases as the diameter of the base circle from which it is drawn increases. That is as the circumference of the base circle becomes more nearly a straight line so the side of the involute tooth also becomes straight. For this reason the sides of the rack tooth are made straight and are inclined to the vertical with an angle equal to that of the line of contact.

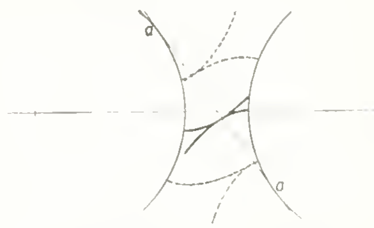


Fig. 3. Laying Out Gear Teeth.

Standard Angle of Contact.

In the standard involute tooth system, the pressure line is inclined at an angle of 14½ degrees with the common tangent to both pitch circles. This angle was adopted as the minimum angle that could be used in an interchangeable system of gearing in which 12 teeth is the smallest number that can be used to

mesh with another pinion of equal size and give uniform motion.

In Fig. 4 are shown the different terms as applied to the parts of the gear tooth. In gearing of the standard form, the thickness of the tooth (t) at the pitch line is made equal to the space in all cut gears, and is thus one-half of the circular pitch of the tooth. In cast gears this thickness is usually made smaller than the space or .48 x P¹. The addendum S that part of the tooth above the pitch line is made .318 times the circular pitch P¹. When the pitch of the gear is based on the number of teeth in the gear per inch of diameter we call it the diametral pitch, and equals the pitch diameter divided by the number of teeth. The addendum of the tooth is equal to the reciprocal of the diametral pitch. As for example, 30 (teeth), divided by 3 (in. dia.) gives 10 as the diametral pitch and the addendum is 1-10 in. The whole depth of the tooth space is equal to twice the addendum (S) plus the clearance (f) and is equal to .687 times the circular pitch P¹. The clearance (f) is equal to one-tenth of the thickness of the tooth at the pitch line in cut gears, or (.1t).

In Fig. 4, attention is called to the location of the pressure line (e f), and the tangent base circle in their relation to the pitch circle of the gear and the pitch line (c d) of the rack. The point

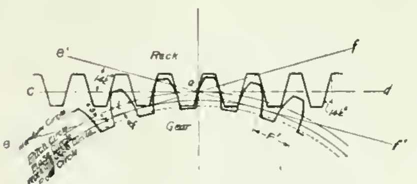


Fig. 4. Laying Out Gear Teeth.

(a), where the pressure line crosses the pitch circle is called the pitch point. In this figure is seen the straight sided rack tooth inclined at an angle of 14½ deg., with the pitch line thus making the angle between the sides of the rack tooth equal to 29 degs.

As an example of the application of the involute to the teeth of gears, let us take the case of a gear with 30 teeth of 4P and layout the tooth of both gear and a mating rack. To obtain the circular pitch from the diametral pitch P, divide 3.1416 by the pitch number thus, $3.1416 \div 4 = .7854$ in. The pitch diameter of the gear is then found by dividing the number of teeth N, by the diametral pitch P or $30 \div 4 = 7.500$ in. Then with the compass draw the circle with O as a centre, as in Fig. 5, and with a diameter equal to 7.5 in. Draw the pitch line (c d) of the rack tangent to the circle at the pitch point. Draw a diameter (y x) interesecting the point of tangency of the pitch circle and the pitch line of the rack at the pitch point (a). From the point, (a), lay off on the circle the distance (a a in.) equal to the circular pitch of the tooth. Bisect this, getting the point (a¹). The space (a a¹), being the thickness of the gear tooth, this distance may be spaced off on the pitch line of the rack to the left of the point (a). Through the point (a), the pressure line

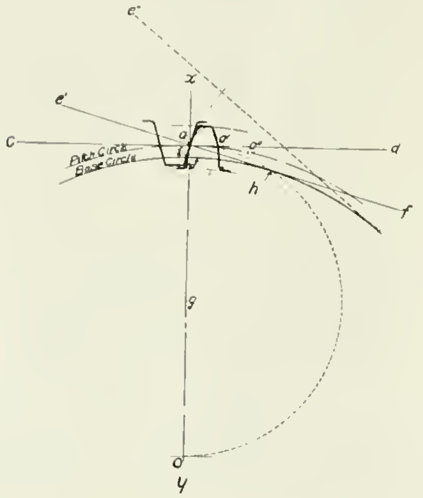


Fig. 5. Laying Out Gear Teeth.

may be drawn at an angle of 14½ degrees with the pitch line of the rack; also the base circle can be drawn tangent to this pressure line from the centre (O). The involute curve for this base circle may now be drawn as explained in connection with Fig. 2. Out from the pitch circle a distance equal to the addendum which is ¼ or .25 in., the addendum circle may be drawn from the same centre (O). The radius of course will be ¼ inch longer than the pitch radius.

The involute curve will extend to the base circle at (i) and from this point in, the tooth is made radial in shape to the point (j) a distance in from the pitch point equal to the addendum or ¼ inch. The full depth of the space below the pitch point being (y) + (f), or .368 times the circular pitch of the tooth, the root circle can be drawn with a radius this much less than that of the pitch circle. The part from (j) to the root of the tooth is composed of a fillet of a radius equal to .05 times the circular pitch of the teeth. The opposite side of the tooth may be drawn in the same manner.

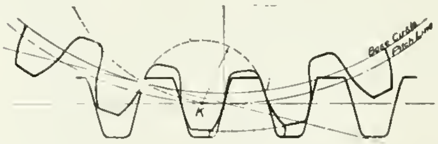


Fig. 6. Laying Out Gear Teeth.

Approximations.

In order to do away with the unnecessary labor of laying out the involute curve a close approximation has been devised for the 14½ deg. system whereby the curve can be constructed by means of the compass. With the compass set at a radius equal to one-quarter of the pitch radius and from a centre (g) on the line (y x) half-way between the points (O) and (a), draw the semi-circle connecting the points (O) and (a). This semi-circle will intersect the base circle at the point (h) which is the point of tangency of the pressure line with the base circle. From (h) as a centre, and with a radius (h a), draw the circular arc from (i) to the addendum circle which arc will coincide closely with the involute already drawn and can be used in its place in drawing the teeth. The fillet can then be drawn with a radius equal to (f), or (.1xt). The above approximation may be used for gears with teeth of more than 30 in number.

In the smaller gears with teeth as few as 20, the curve for the involute may be drawn as for those with 30 or more but the flank or that portion of the tooth below the pitch line must be obtained by different methods as it ceases to be a simple radial line. It becomes a curve closely approximated by an arc of a circle drawn from the centre (k) which is located on the pitch line in the centre of the tooth between the teeth whose flanks it forms as in Fig. (6). The radius of the arc is equal to (k i). The fillets are drawn with a radius equal to one-seventh the distance between the points of the teeth on the addenda circle (1 1).

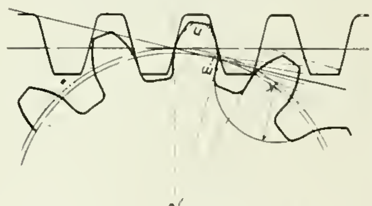


Fig. 7. Laying Out Gear Teeth.

For pinions with less than 19 teeth, the flanks are made radial for a distance in from the base circle equal to 3.5 divided by the product of the number of teeth times the diametral pitch, or $3.5 \div NP$. With the compass set at the point (k) as a centre and a radius of (k m), draw the curved portion of the flank and fill in with the fillet as in the case of the gears with twenty teeth.

For gears with small numbers of teeth, the face of the teeth will be more pointed than should be if drawn by the approximate method above given, and in cases where extreme accuracy is required, the face should be drawn by means of a constructed involute. It is not necessary to construct an involute for each tooth. Design one tooth only and draw in the others by means of the compass set to a radius that will give the nearest approximation to the involute as constructed. The difference between the two methods is most noticeable in the case of the twelve tooth pin-

(Continued on page 580.)

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

RELIEVING THE FOREMAN.

By A. E. S.

IT is notorious that very little information regarding the process and routing of the work can be got from the average blue print. In fact, the average foreman considers himself lucky if he gets blue prints that are properly and completely dimensioned. The draftsman seems to think that if the drawing is sufficiently clear to be made out by the man in charge, it has well accomplished its whole purpose.

One foreman of our acquaintance being unable to move the designer to be more explicit, has accomplished his end by making a couple of parallel slits in one edge of the tracing so as to leave a free strip narrow enough to go into a typewriter. He then dictates such directions to the stenographer as he wishes to be carried by the blue print for the operator's information. By thus making the drawings self-explanatory, he has a much larger proportion of his time to devote to profitable work.

IDENTIFYING DIFFERENT BRANDS OF TOOL STEEL.

By Peter M. Blair.

Considerable trouble was experienced by a Western Ontario manufacturing concern in distinguishing the different brands, grades and makes of bar tool steel and high-speed tool steel. They were large users of the various kinds of tool steels and carried a considerable stock on hand at all times. It, however, frequently became mixed in the storage racks, and it was then often impossible to distinguish one brand from the other.

Under the new method, a colored chart has been adopted and one furnished to each department in duplicate, this chart being made up in the same manner as the colored cards issued by paint manufacturers. Against each separate block of color is the name of the steel and brand for which that color stands.

Where the brand of steel is identified by painting merely the ends of the individual bars, the identification is frequently lost, the color not being replaced on the fresh ends. With the new arrangement, when a shipment of steel is received, each bar is painted with a colored stripe a half-inch wide, and extending the length of the bar.

When an order is sent to the steel storage department for some one definite brand of steel and the bar has to be cut the remaining piece is still identified by the full length colored stripe.

The foreman issuing the requisition in this way also sees that he receives the steel he specifies on his requisition by consulting his chart.

DEMAGNETIZING MILLING CUTTERS.

The utility of magnetic chucks in planers, shapers, grinders, and other machine tools is well known, but such holding devices have not hitherto been considered suitable for use on milling machines owing to the milling cutter becoming magnetized by stray field from the chuck and consequently becoming covered with chips which foul the cutting edges and damage the surface of the work.

To eliminate this trouble and make possible the use of magnetic chucks on all milling jobs, the Magnet-Werk firm, Eisenach, supplies an alternating current electromagnet to be mounted over the milling cutter, so that in a horizontal spindle machine the cutter runs in an arched recess below and between the poles of the magnet. On exciting this magnet by alternating current of any frequency available in practice, an alternating magnetic field is established round the milling cutter, and the latter is kept demagnetized during working.

Chips will not adhere to the cutter, but the working of the chuck, which is powerfully excited by direct current, is unaffected. Chips thrown up by the cutter or carried round with it mechanically are attracted by the alternating current magnet core and may easily be cleared from time to time from the space between the magnet and the cutter. The auxiliary magnet then prevents the cutter becoming choked by either magnetically or mechanically attached chips, and, owing to the fact that it is excited by alternating current, it is itself easily kept clean.

The form of the alternating current magnet core can be adapted to the particular type of miller concerned, and should alternating current supply be not already available, a small alternator can be driven from any convenient line shaft. This demagnetizing and chip removing device is, of course, applicable with advantage even where magnetic chucks are not used, and can be used to demagnetize tools and other steel pieces which by one means or another have become magnetized.

LUBRICATION.

By M. L. S.

ALONG with the development of the heat treatment of steel and of high rotative speeds, successful lubrication is one of the most necessary qualifications of the light, powerful machinery which is finding so many uses in the mechanical progress of to-day.

The old method of squirting oil on the shaft through a hole in the bearing at more or less irregular intervals, is not only impossible in some of the recent high-power machines, but by forming an efficient trap for the collection of dust and grit and its tendency to run out and collect on surrounding objects, makes it a positive detriment.

Three systems of lubricating high-pressure and high-speed bearings are coming more and more into use, namely, grease, forced, and flood. The grease or hard oil system is being used largely by manufacturers of domestic machinery, motors, implements, etc. It has the advantage of cleanliness and can be so introduced as to keep the bearing fairly well lubricated until the period for which the machine is guaranteed expires, after which the builder is not so directly concerned.

Force feed oiling systems are particularly valuable where even distribution is required, and this method is one of the individual factors that has made the steam turbine and high speed generator possible. It is and will be the most popular method of lubricating high-speed prime movers.

The up-to-date method of lubricating machine tools of high power is, however, the flooding system. It consists of pumping oil in a continuous stream to the higher bearings and draining from these to those lower down, and so on back to the tank, usually in the base of the machine. The attractive feature of this system is that the oil flowing completely over the bearing exercises a cooling effect as well as that of lubrication. Foreign particles are completely washed away before they can get into the bearings, the oil can be used over and over again, and the operation of the system is always under the observation of the operator.

AUTOMATIC TOOL CHECK.

A FIRM who have been experiencing trouble with loss of their workmen's tools have had racks built, designed to hold each tool used. If at closing time a single tool is missing, it is indicated automatically, without counting or checking, by its absence. Again, if occasionally a tool is being repaired, a numbered repair card is inserted in place of it, indicating where the missing tool is.

FROM GREY-DAWN TO BLUE-DUSK.

By James E. Cooley.

The difference between a man jogging along in an ox-cart in the year one, and the man spinning along in an automobile in the present day is the difference between the man who is afraid of change, and the man who goes forth daily and batters down the old to set up the new.

Far back in aeons of time you were once a scaly animalcule placidly sleeping on an alluvion shore when one day you woke up, or came to, and started forth alone. Up the elevating slopes, over hills and down dales you went, until you arrived at what you are to-day. What you are now, you have made yourself; nothing else has made you. You have not been a "child of destiny," or subject to "geological changes." You've come up the "ascending scale" by your own exertions—by your own nerve.

Because somewhere back in a distant age someone had the nerve to erect a house in the open instead of living always in a cave, and because someone had the nerve to use a dug-out log for a boat as a means of transportation, others began doing the same thing—began to use their nerve. It was these leaders and their imitators who were always in the van—always in style. Imitating is not such a disagreeable thing, for some of these imitators soon produced better houses and better boats. We've lent a hand and given each other a boost and all that sort of thing, but it's only by our own nerve, the kind that produces something, that we are advanced.

If you look at a mansion and then at a hovel, you will see that the mansion was produced by one with a bigger nerve, than the one that produced the hovel. If you see a man holding a responsible position and thoroughly interested in his work; and one out of employment who believes he is down and out, you will see which of these has got the most nerve, and if you have your eyes open you will see that in this world productive nerve is pretty near the whole thing; and—as regards yourself—if you expect to occupy a niche in the hall of fame, or leave some trace of a worthy deed behind you, to show that you once existed, you have got to get busy and put your nerve to work.

Nerve is that mighty thing that impounds the waters of a lake and cuts a continent in two; that thing that goes in and pulls down ram-shackles, drives out disease and dirt, in the name of sanitation and health. It is the thing that is going to destroy the saloons and penitentiaries, abolish the divorce evils and re-establish homes. It is going to wipe out prostitution, take girls and women from the streets and place virtue back upon its throne. It is that thing that will yet develop a better race of men and women, turn the bad into good, and make this Earth a Paradise.

Are you going to have a part in this great drama? Going to be just an onlooker in the galleries, or are you coming down to help shift the scenery? It is in your power to bring on all these changes. It is in your power to pave the way for this better day. It is within your ability and courage to render a magnificent service, if you've only got the nerve to do it.

Up then, and do something. Up with your nerve and create something. Don't stop to read the achievements of yesterday for inspiration. Don't stop to study the heroes of the past to spur you on. Look at nothing but yourself, roll up your sleeves, buckle in and begin. Hitch up your mighty steed nerve, and with a chain to its harness pull down the rocks and boulders that for centuries have impeded the progress of man. Sit stiff upon your loyal steed, scan the horizon with your piercing eye, gather fresh energy each hour and work well, and work hard with all your might.

From grey-down to blue-dusk put your best self into your work. From grey-down to blue-dusk look straight ahead; don't ever give up. From grey-dawn to blue-dusk keep your nerve keyed up, and your soul on fire, and accomplish something useful. The world wants your achievements—your creations. It wants to place at your feet its richest and noblest gifts. It wants to pay you a glad ovation. It wants to carve your name upon its biggest shaft; name after you its children, its cities, and a new-born star, and bid you walk down the corridors of time.

REVERSING MOTOR DRIVE FOR MACHINE TOOLS.

THE subjoined data compare the power requirements and general performance of a 25 h.p. (nominal) planing machine driven by: (1) Simple belts; (2) double belts; (3) high-speed pneumatic coupling; (4) low-speed pneumatic coupling; and (5) direct coupled reversing electric motor. Direct electric driving effects 50 per cent. or more reduction in transmission losses in some cases, but in other instances the saving in this direction is much smaller. The actual power requirements during the cutting stroke are much the same whichever driving systems be used, but the slip loss is about six times as great with simple and three times as great with double belts as with pneumatic couplings or with direct electric drive.

In a particular series of tests (quoted in Werkzeugmaschinenbau) the relative power expenditure on light load was: Direct electric drive, 1.00 (assumed); low-speed pneumatic coupling, 2.3; high-speed pneumatic coupling, 4.0; simple belt drive, 4.75; double belt drive, 5.25. The cutting work performed per minute by direct electric drive was 42.2 per cent. greater than by simple belt drive. Further data comparing the several driving systems are presented in the following table:

VARIOUS SYSTEMS OF DRIVING 25 H.P. PLANING MACHINE (9 FT. STROKE).

Driving System.		1	2	3	4	5
Cutting load	H.P.	25	25	24	26	31
Full load with light reverse	H.P.	55.5	45.3	75	25	20
Full load with loaded reverse	H.P.	.25.0	55	36	15	20
Light return	Secs.	7.2	7.2	7.6	6.8	5.6
Duration of cycle	Secs.	27.2	27.2	27.1	22.8	19.0
Light return speed	ft./min.	22.2	22.2	21.8	23.5	28.6
Cutting speed	ft./min.	8.0	8.0	8.2	10.0	11.9
Ratio of cutting to return speed	I:	2.78	2.78	2.57	2.35	2.40

Reversing motor drive offers similar advantages in the case of wire and tube drawing machines, boring machines, turret lathes, etc.

There is to-day no excuse for retaining couplings and stepped pulley combinations which are costly to maintain and inefficient in operation. In the case of reversing machines, rapid yet smooth reversal is effected electrically by the automatic actuation of several braking steps on a controller; such graduation cannot be attained mechanically. Cutting and reversing speeds being independent of each other where electric drive is used, any desired number of speeds can be provided, and the lowest cutting speed may be combined with the highest speed of reversal or vice versa.—Engineering Review.

K. W. Blackwell, vice-president of the Canadian Steel Foundries, Ltd., who has been visiting the Old Country, is expected home this week.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

With the further development of this course in arithmetic, it will be found by those who have followed the introductory lessons and profited by them that the various practical applications resulting from the succeeding lessons will be easily observed and their time and labor-saving features so appreciated as to be adopted at every available opportunity.

MENSURATION OF SOLIDS.

In our May 28 issue, mensuration or measurement of lines and surfaces was explained, and examples of its practical application given relative to familiar shop equipment. The measurement of solids is discussed in the present instance, well known accessories to mechanical engineering products being again the examples of its application.

A solid, or body, has three dimensions: length, breadth and thickness, and the entire surface of a solid is the area of the whole outside of the body, including the ends. The volume of a solid is the number of unit volumes it contains, as cubic inches, cubic feet, etc.

A prism is a solid whose ends are equal polygons, and parallel to each other and whose sides are parallelograms.

A cylinder is a round body of uniform diameter, with circles for its ends.

The convex surface of a right prism or cylinder is the perimeter multiplied by the height or altitude. The volume of a right prism or cylinder equals the area of the base multiplied by the height. (See Chart 20.)

A cone is a solid whose base is a circle and whose convex surface tapers uniformly to a point called the vertex. The convex area of a right pyramid or cone equals the perimeter of the base multiplied by one-half the slant height. The volume of a right pyramid or cone equals the area of the base multiplied by one-third the altitude.

If a pyramid or cone be cut by a plane parallel to the base, the lower portion is called the frustrum of a pyramid or cone. The volume of a frustrum of a pyramid is found by multiplying the sum of the areas of the upper base, the lower base, and the square root of the product of the areas of the two bases, by one-third the altitude. Or by formula:

$$\text{vol.} = \frac{1}{3} h \left(A + a + \sqrt{A \times a}\right),$$

in which h = altitude, A = area of upper base, and a = area of lower base.

Example:—What is the capacity of a tub, 14 inches high, 28 inches dimeter at the top and 20 inches diameter at bottom? Assume 7.477 gallons to the cubic foot.

By formula:

$$\text{vol.} = \frac{1}{3} h \left(A + a + \sqrt{A \times a}\right).$$

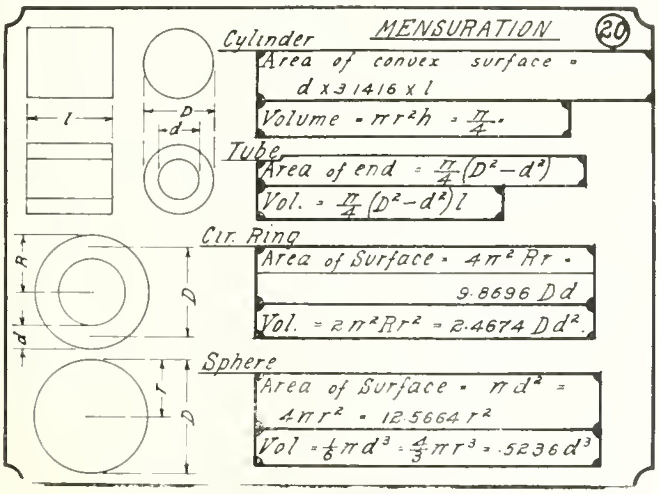
Capacity in gallons:

$$7.477 \times \frac{\frac{1}{3} h \left(A + a + \sqrt{A \times a}\right)}{1728}$$

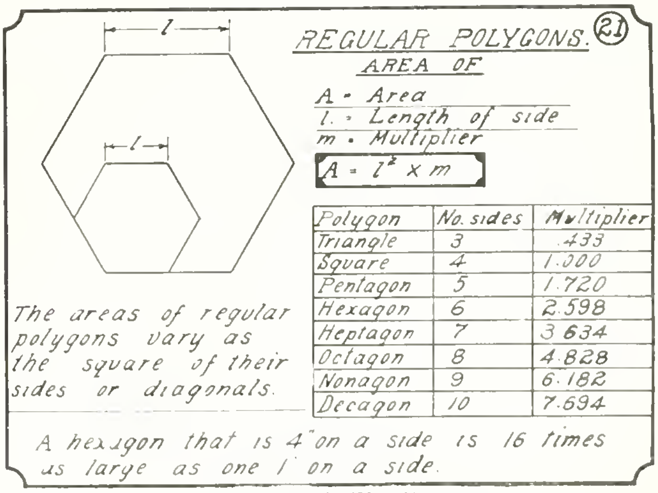
$$= 7.477 \times \frac{1}{3} \times \frac{14}{1} \times \frac{1369.81}{1728}$$

= 27.665 gallons.

A sphere or ball is a solid bounded by a uniform curved surface, every point of which is equally distant from the centre. The area of the surface of a sphere equals the square of the diameter multiplied by 3.1416. The volume of a sphere squals the cube of the diameter multiplied by .5236 (see Chart 20).



ARITHMETIC CHART 20.



ARITHMETIC CHART 21.

Example: Required the diameter of a cast iron ball to weight 12 lbs. Assume the weight of cast iron to be .26 lbs. per cubic inch.

The volume of the ball will be its weight divided by the weight of one cubic inch, or 12 ÷ .26 = 46.15 cu. in.

Then by formula (chart 20) volume.

$$46.15 = .5236\, d^3 \text{ or } d = \text{cu. rt. of } \frac{46.15}{.5236}$$

= cu. rt. of 88.14 = 4.45 inches.

To find the area of a disk or washer, multiply the difference between the squares of the two diameters by .7854, or by formula (Chart 20):

$$\frac{3.1416}{4} (D^2 - d^2) = .7854\, (D^2 - d^2)$$

The volume of a hollow tube equals the area of the end multiplied by the length. Example: What is the weight of a 9-foot length of hollow tubing, with an external diameter of 6 inches, and an internal diameter of 3.5 inches?

Assume the weight of the steel to be .282 lbs. per cu. inch.

By formula (Chart 20),

$$\text{Vol.} = \frac{3.1416}{4} (D^2 - d^2)\, L$$

$$= .7854\, (6^2 - 3.5^2)\; 9 \times 12$$

$$6^2 - 3.5^2 = 36 - 12.25 = 23.75$$

Then weight of shaft:

$$= .282 \times .785 \times 23.75 \times 9 \times 12 = 568 \text{ lbs.}$$

To find the area of regular polygons. Square the length of one edge, and multiply by the constant or multiplier found in (Chart 21) using the formula,

$$A = L^2 \times m.$$

Example: What is the weight of a 12-ft. bar of hexagon steel whose edge measures 2 in.? Assume the weight of a cu. in. to be .288 lbs.

By formula, $A = F^2 \times m$.

Volume = $A \times$ length of bar in inches.

Weight = $.288 \times$ volume =

$= .288 \times 2^2 \times 2.598 \times 12 \times 12 = 431$ lbs.

Knowing that the area of regular polygons vary as the square of their sides or diagonals, what would be the weight of a 12-ft. hexagon bar of similar steel whose edge measures $1\frac{1}{4}$ inches?

Let X = required weight:

$X : 431 = 1.25^2 : 2^2$, or

then

$$X = \frac{431 \times 1.25^2}{2^2} = \frac{431 \times 1.25 \times 1.25}{2 \times 2}$$

= 168 lbs.

PROPORTION IN MACHINE TOOL DESIGN.

Many inventors qualified by long practical experience to effect improvements in machine tool construction are possessed of limited theoretical knowledge and do not realize the varying influence of changes in scale on the necessary actual dimensions of machine tool parts and the forces acting or permissible thereon. On grounds of economy they construct small scale models, perfect the latter and then expect to obtain equally satisfactory results in a full-sized machine, say, five or ten times as large as in every vital part. The fallacy underlying this assumption is easily exposed by a particular example.

Suppose that a part of weight P slides on a surface S in the model. The frictional resistance per unit will be represented by $u \times P / S$. If all dimensions be increased n times, the weight of the full-sized slider will be $(n^3 \times P)$ riding on surface $(n^2 \times S)$ and offering $n \times (u \cdot P / S)$ frictional resistance per unit area. The total frictional resistance equals that in the model multiplied by:—(1) n, taking account only of unit surface; (2) n^2, allowing for the fact that the total surface increases with the square of n; (3) n, to allow for the n times greater travel in given time. The total effort required, therefore, increases about sixteen times even if the dimensions of the model be only doubled.

The force applied to the slider may be F in the small scale model. In the full-sized machine, the surface being $(n^2 \times S)$ the force may be $(n^2 \times F)$ to preserve the same loading unit area (the materials being assumed the same in each case). Thus the applied force may be only n^2 times that in the model, whereas the frictional resistance will be n^4 times as great as in the model. Such an increase in the relative importance of frictional resistance may easily condemn the whole design. —Conserv. nat. des Arts et Metiers.

SUBSTITUTE FOR CLAY IN RE-BABBITTING.

Owing to the high speed used on buffing and polishing lathes, and the heavy wear on same, the re-babbitting of these machines is necessary. As a substitute for clay in re-babbitting bearing boxes, the following has been found very practical and economical. It sticks well, will not blow out or soften with hot metal contact, and can be used many times over by the addition of a very small quantity of oil when softening it again. It is far better than clay or putty when either is used alone.

Reduce putty with cylinder oil until it is almost as thin as the oil itself; next take some powdered asbestos pieces (old asbestos pipe covering ground up will do) and add to the putty mixture until you get a stiff compound as dense as the putty was in its first state. Use this in any way, and it will give entire satisfaction.

A WORD TO THE BOSS.

It would pay every employer and every manager to take these words of friendly counsel to heart.

If you want to improve your staff don't get on their nerves—get at their brains. The nagging boss never cures the lagging assistant, and a policy of pin-pricks punctures the soundest enthusiasm in time. You can no more henpeck a staff into doing their best than you can spank a howling child into a smiling good temper. If you're always down on a man, it's all up with his chances of doing well.

It's the irritable master that makes the sullen servant, for the more snappish you are, the less "snap" will there be on the part of your men. It doesn't pay you to have a dissatisfied staff, for you won't grind dividends out of discontent. A grumpy staff means an empty shop. Scowling faces frighten away customers.

Don't be annoyed if your men don't always share your opinions on business matters. You can't expect every one you employ to see the world through your eyes. You must make allowance for the personal point of view. You're a fool to make your men mere imitations, mere parrot echoes of yourself. Let them develop their own ideas. Make them men, not machines. If you don't make the best of your men, you'll never get the better of your rivals; and if you want a man to use his head, don't treat him merely as a "hand."

A blunt employer is apt to say some very sharp things. That's all very well on occasion; but don't be everlastingly sneering at the stupidity of your staff. A friendly pat on the back sometimes lightens a man's task more than a heavier pay envelope does, and little kindnesses do more than big money to insure a loyal staff.

Better have a loyal staff of men who make mistakes sometimes than of clever, discontented workers who simply loathe you, and don't care a tinker's curse whether the business goes down or not. Don't you think so?

WEALTH FROM MANUFACTURES.

The country that sells raw materials will always be poor, just as the farmer who sells corn, and not hogs, will never lift the mortgage. If you have a forest, and can work it up into tables, chairs, bookcases and violins, you will make a deal more money than if you sell firewood.

The United States has one-sixteenth the population of the world, but it has one-third the wealth of the world.

The North American Indians had the raw stock, but they did not know how to use it. Our wealth comes from the ability to combine coal and iron-ore; lumber and steel bolts; leather and shoestrings; paint and glue; rubber and steel. So we have supplied the world with automobiles, shoes, farm implements, locomotives, engines, brass castings, machinery and manufactured commodities in a million forms, and to-day there is being brought into America in payment for goods manufactured in the United States five thousand five hundred dollars every minute for ten hours, three hundred days in the year.—The Philistine.

LAYING OUT GEAR TEETH.

(Continued from page 576.)

ion as shown in contrast in Fig. 7, where the approximate curve is drawn in broken lines at (n).

A rack constructed with the theoretical straight tooth will interfere with the teeth of all milled mating gears with less than 30 teeth, the point of the rack tooth hooking into the flank of the mating tooth near the base line. This will happen in all cases where the tooth of the gear is constructed on the radial flank principle which is the case in all milled teeth. To overcome this to some extent, the tooth of the rack is rounded at the point as in figure (7), the radius of the arc being taken as .67 times the circular pitch, or 2.10 divided by the diametral pitch.

The above rules give teeth of form very close to that of the standard gear cutter and should not be mistaken for that of teeth produced by hobbing or other generating systems. The tooth of the generated gear is not of the radial flank type, but is purely involute in form and is based on the uncorrected straight-sided rack tooth which gives the teeth of pinions the slightly undercut form.

Machine Tools of Canadian Design and Manufacture

By M. L. Smith, B.A.Sc.

The machine tool industry of Canada, although of modest proportions relatively, represents nevertheless, in its variety products, achievement comparable with that realized in those of our most progressive manufacturers, a circumstance largely due to highly competitive conditions. This series of articles will feature the more prominent specialties of Canadian machine tool builders.

SPECIAL PUNCH AND SHEAR.

NOT a few of Canada's greatest manufacturing institutions owe their success to a pronounced ability to meet and adapt their products to particular conditions and requirements. A pointed case of this is seen in one of the latest shearing machines put on the market by the John Bertram & Sons Co., Dundas, Ont.

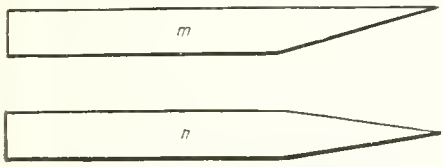


FIG. 2. DRIFT BOLT PRODUCTION

This consists of their No. 5 single punch and shear specially arranged for the use of contractors, structural workers and for harbor and dock construction. Such services necessitated a specially flexible arrangement of machine and attachments for punching and shearing structural shapes, slitting and cutting off stocks, etc.

The attachment illustrated, is designed for the production of finished drift bolts of any size from the bar in a single progressive operation. The bar is first cut off in lengths to make two bolts as shown at (a) Fig. 1. It is then sheared diagonally by the shear blade (d) producing two bolts of the form (m) Fig. 2. The points are now bent in position (b) by the die (e) Fig. 1. to give the finished form of bolt illustrated at (n) Fig. 2.

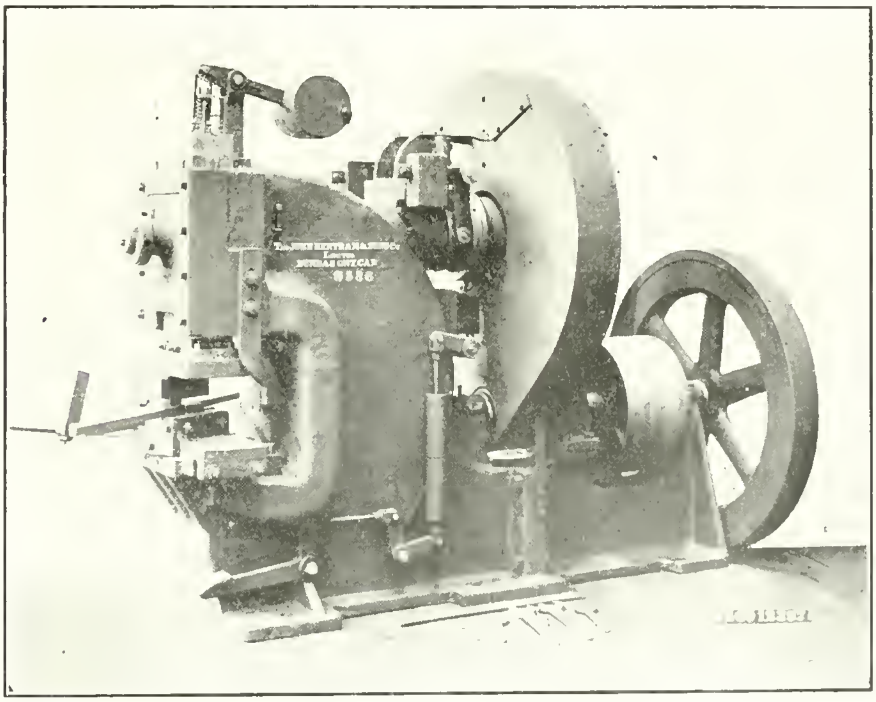


FIG. 3. SPECIAL PUNCH AND SHEAR

Considerable difficulty was encountered in designing a satisfactory shearing die for the second operation. This, has, however, been overcome and drift bolts up to $1\frac{1}{4}$ in. square are turned out with clean straight points. All body parts of the attachment are steel castings and can be quickly interchanged for other appliances.

The machine complete is shown in Fig. 3. The frame is a semi-steel casting having main bearings lined with bronze bushings. The ram is also a steel casting and is provided with a suitable counter weight to facilitate hand adjustment of punches and shears. The balance weight has a heavy coil spring attached to prevent the shock of punching hard materials from breaking the weight levers. A bronze wedge gib provides for taking up all wear. The eccentric cam is also a bronze bushed steel casting and has a hardened steel shoe.

In common with the company's general practice, the gag attachment is removable for replacement by other attachments. The steel clutch has an automatic stop adjustable to any position of the ram stroke. Safety of the operatives is well looked after in that all gears and dangerous parts are complete-

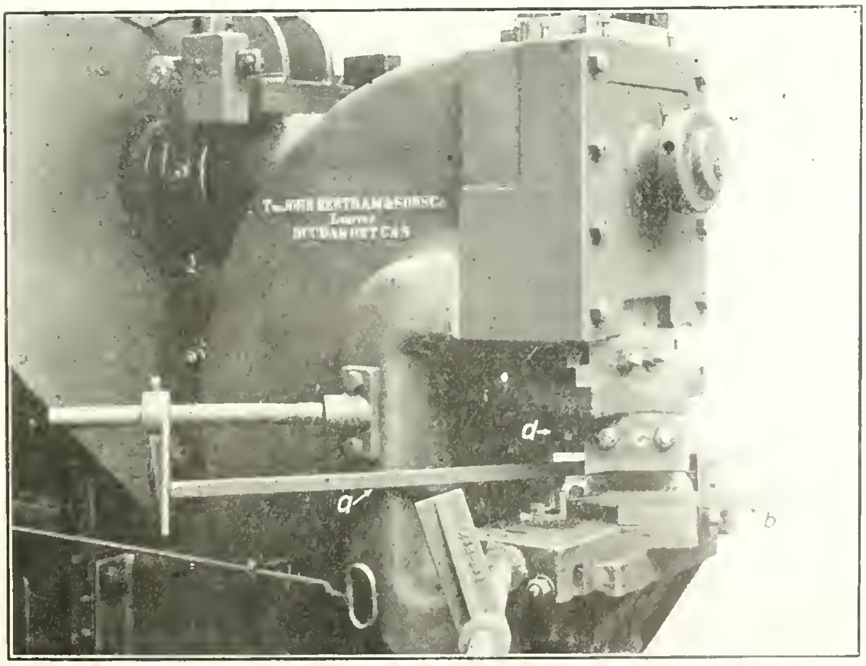


FIG. 1. SPECIAL PUNCH AND SHEAR.

ly encased. The pilot for turning ram down for adjustment of tools has a safety ratchet which at all times, protects the workman from injury in case the lever is not removed before throwing in the clutch.

The structural jaw attachments for handling channels, I-beams, etc., are, like the spike making and other parts, made of steel castings giving a minimum of weight to these necessarily, very strong sections. The Bertram Company have recently supplied a number of these machines along with large equipments to the several new Canadian car and structural steel companies from their plant at Dundas, Ont.

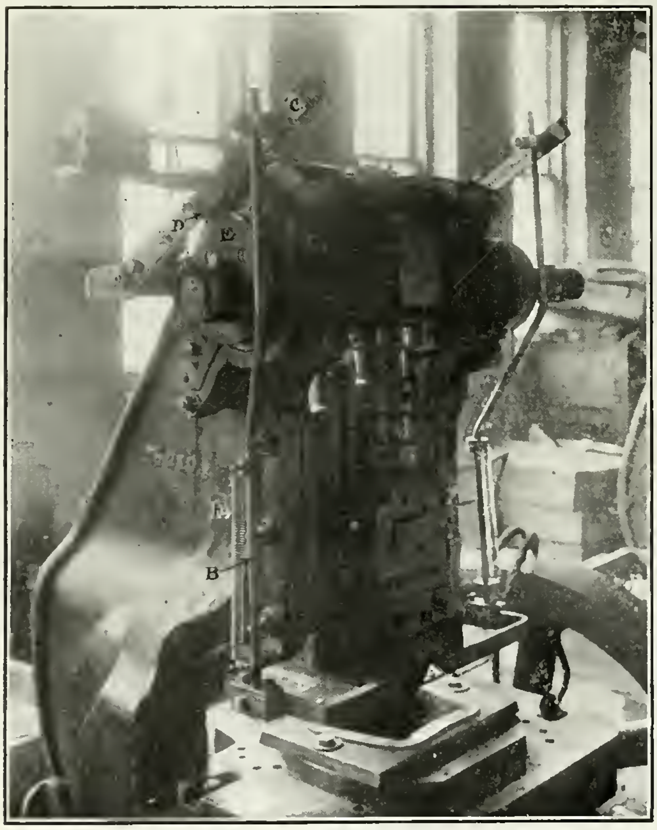
SAFETY DEVICE FOR PRESSES.

THE Wright-Stacey Protection Co., Hamilton, Ont., have recently put on the market, a new safety device for attachment to power presses. The device, which is simple in construction, has been patented in Canada, the United States, England and Germany.

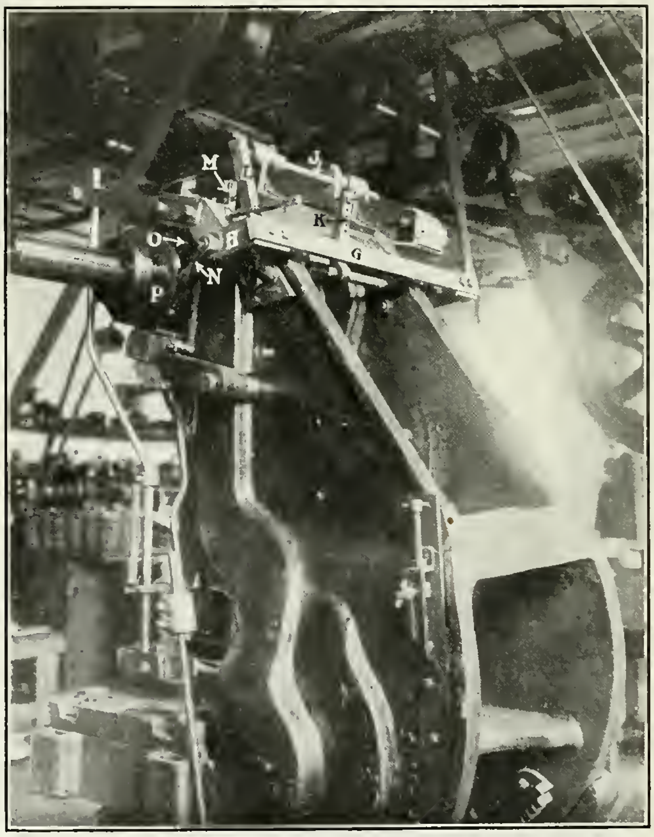
As will be seen from the illustrations, it consists of a guard A formed round the punch and moved by vertical rod B connected to lever C, to which is attached roller D. The cam E revolves with the driving shaft of the press, and imparts an up-and-down motion to the guard through lever C. The spring F assists in preventing any lost motion and is adjustable according to the length of stroke of the press.

When in operation, the guard travels ahead of the punch, and, as already stated, is operated by cam E, which also imparts to frame G, through lever C, a rocking motion, the frame being pivoted at H. The movement of frame G imparts a similar motion to rocking shaft J through levers K.

The lever L on end of rocking shaft, strikes the arm of lever M towards the front of press. This action causes bottom arm of lever or stop-dog N to move out in the opposite direction, and by so doing it clears clutch pin O as it comes round at each revolution of the shaft. If, however, the guard meets an obstruction, such as the operator's fingers, the motion of the punch is immediately arrested. When the guard stops, all movement in frame (G) also ceases, thus preventing levers K from moving rocking shaft J. By this means, the stop-dog is held in its normal position, that is, against hub P, and is ready to engage with clutch pin O as it comes round. The guard traveling ahead of punch reaches the die when the punch has traveled one-third of the stroke. Although frame G is moving all the time the punch is in motion, the rocking shaft and stop-dog are only operated during the last $\frac{1}{8}$ in. drop of guard. It will readily be seen that if there were 3-16 in. between guard and die, there would be no movement in rocking shaft and therefore the stop-dog would be in position to engage clutch pin and stop the punch. The guard is adjustable to any size of punch and is held in position by a clamping device. The device is shown attached to a Brown & Boggs Co. press.



SAFETY DEVICE FOR PRESSES.



SAFETY DEVICE FOR PRESSES.

FRACTURED CRANK SHAFT.

After working some considerable time, a large crank shaft fractured through an arm of the crank connected with the high-pressure cylinder. Under shock tests it showed up badly, and its microstructure indicated that it had been overheated. From the indicator diagrams and the weight of the moving parts, the stresses existing in the crank shaft were calculated. The results show that the stresses were not high enough to account for fracture, assuming that the engine had been properly assembled when new. The positions of the bearings, however, had not been happily chosen, which would give rise to greatly increased stresses after wear had taken place, e.g., a wear of 3 mm. on the end—fly-wheel—bearing would just about double the stress on the crank arm which ultimately fractured.

Ottawa, Ont.—Tenders will be received up till June 10 for the supply of certain laundry machinery, including motors and a 16 to 18 h.p. vertical boiler, to be delivered and installed at the Isolation Hospital. Plans and specifications may be obtained from T. A. Lomer, Medical Officer of Health, Ottawa, Ont.

MACHINE TOOL DEVELOPMENT

A Record of Progress Towards Higher Quality and More Economical Production in Machine, Pattern, Boiler and Blacksmith Shops, Planing Mills and Foundries

TEMPERATURE CONTROL OF OIL BURNING HEAT TREATMENT FURNACES.

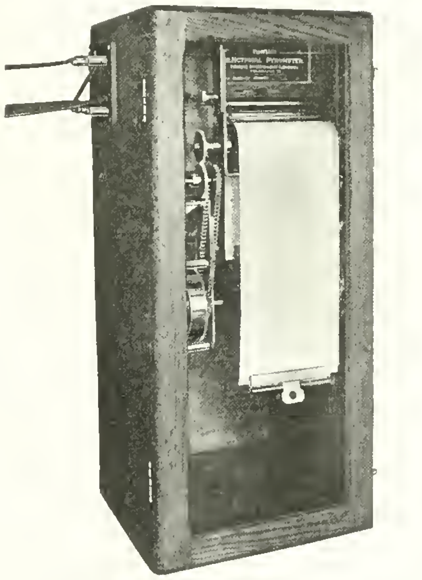
A NOVEL device for automatically controlling the temperature of an oil burning annealing furnace has recently been installed by the Tioga Steel and Iron Co., Philadelphia, Pa. This company experienced considerable difficulty in successfully treating a high point carbon steel, which they were using in large quantities until they adopted the use of pyrometers. Some interesting experiments were conducted to ascertain the elongation and tensile strength of various bars of steel treated at three maximum temperatures, and a definite basis determined upon for future action.

Inasmuch as the work under way was extremely important and involved a considerable amount of money, it was decided that the dependence upon the average workman to prevent the overheating of the steel was decidedly unsafe. Therefore, it was decided to attempt to automatically control the temperature of the furnace in which the largest amount of this work was being done, the idea being to allow the furnace to gain the proper annealing temperature and allow the steel to soak for a number of hours at this temperature.

The installation consists of a Thwing recording pyrometer, manufactured by the Thwing Instrument Company, 445 North Fifth Street, Philadelphia, Pa., located in the office of the Tioga Steel and Iron Company, some 350 feet from the furnace in question, connected directly to a thermo-couple placed in the roof of the furnace, and recording temperatures every half minute upon a daily chart. Directly under the pointer of the recorder, as shown in illustration, are mounted two strips of contact metal, one strip running the entire width of the gap over which the pointer moves, the other mounted upon an insulating piece of fibre, being arranged in such a manner that it may be slid back or forth upon the first piece of contact metal.

As the pointer begins to move under the impulse generated by the thermocouple, it assumes a position above the chart corresponding to the correct temperature of the furnace. Every half minute it is depressed upon the chart, passing through a thin film of ink, which is contained in a tapered groove near the front edge of the ink-pad. As it comes in contact with the chart, the electric contact is made by means of an automatic switch mounted on the face of the clock, which drives the drum carrying the chart. The circuit is then completed by the front section of the pointer, resting upon the lower strip of contact metal, passing through the pointer and back over the depress or frame, and out of the recorder to the relay. The pointer being insulated at half its length from the pivot on which it swings, no current is allowed to pass through the galvanometer other than the small current generated by the thermo-couple.

When the temperature rises sufficiently to make a depression of the pointer



THWING RECORDING PYROMETER.

upon the movable contact which has been set at the temperature at which it is desired to hold the furnace an entirely different circuit is completed. On the outside of the recorder are three binding posts—one connected to the lower contact strip, the center (or common return) connected to the depression frame, and the third to the movable contact. These are connected to a relay, designed to handle 220 volts at 0.1 ampere, mounted on the switchboard of the private power plant operated by the Tioga Steel and Iron Co.

Mounted on the oil line is an electrically-operated solenoid valve, which is connected through a relay to the three binding posts on the recorder. While the temperature is rising, the relay completes a circuit which holds the valve open, allowing the oil to flow into the furnace as soon as the temperature reaches the predetermined point, and contact is made on the movable piece of contact metal, the other side of the relay is actuated and the valve closed, shutting off the oil, and, of course, causing the temperature to fall. As soon as the lag of the furnace has been overtaken, the recorder will register this drop in temperature, when the pointer will be depressed upon the lower contact, closing the first circuit and opening the solenoid valve, again allowing oil to flow into the furnace.

By an ingenious device, it is rendered impossible for the circuit to be made more than once on either contact; i.e., when the valve is open the repeated depressions of the pointer on the lower contact have no effect and the valve will remain open until the temperature has risen to the point marked by the movable contact, when the circuit first mentioned will be broken by the relay and the second circuit made by the recorder pointer. This applies also in the matter of falling temperatures.

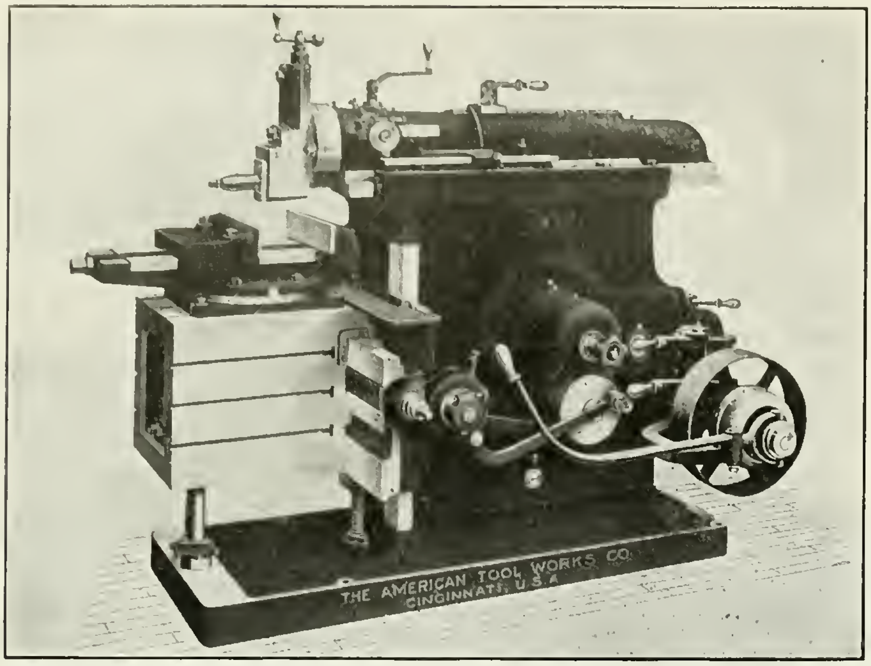
The control of temperature is rendered very close, depending somewhat upon the matter of the time lag of the furnace, but by averaging the increment of temperature after the oil has been shut off it is easy to control the temperature to a very close degree. This control of temperature is positive and obviates any carelessness on the part of workmen, and in addition effects a considerable saving in the consumption of oil, as the furnace is maintained at the proper temperature by the use of considerably less oil than where hand manipulation of valves is depended upon.

The indifferent attitude of the average workman toward the temperature of the furnace which he is tending is too well known to need comment among steel or iron men, and the introduction of an automatic device for regulating such temperatures is a decided step toward economy, not only in material and time, but in the item of labor, as such devices can care automatically for a number of furnaces, which would otherwise require an attendant for each.

AMERICAN HEAVY-DUTY SHAPERS.

The illustration and description refer to the essential points observed in the construction of "American" Heavy Service Shapers. The power end is designed for the heaviest work to which the machine can be applied, and consists of extra wide four-cone pulley with very high speed counter shaft and 3-in. belt, which,

with back gear, gives eight cutting speeds. All useless high or low speeds are eliminated, and the variations are kept within the working limits. The stroke can be changed at will while the machine is in motion.


NEW HEAVY SERVICE SHAPER.

The ram and rocker arm are especially designed for stiffness, the latter being rigidly connected to the shaft at the bottom. This supports all weight of arm and parts, thus removing the dead weight from the slide bearings. The ram is so connected by means of a double link that the pull is always downwards during the cutting stroke, which effectively offsets the rising tendency of the tool point.

There are thirty-two cross-feeds, ranging from .006 to .200 in. per stroke, which may be changed and set while the machine is in motion. The feed is reversed by a plunger engaging in opposite sides of a swinging gear. The mechanism is provided with a safety device in the form of a fibre friction washer, the pressure on which can be regulated to do all the work required of the feed but to slip in case of accidents or forgetfulness of the operator.

The base is large and of the pan type, with ample provision made for cleaning and draining. The tee slots in the table are cut from the solid and in directions to prevent bolts falling out when loosened. The bearings on the top, back and face of the apron are designed for maximum surface and strength and are fitted with serviceable chip guards. A stationary screw provides for the vertical adjustment of the table through a ball thrust nut, thus obviating the necessity of making a hole in the floor.

The head may be operated through any angle up to 100 deg., and the down-slide, in common with the ram-slide, is adjusted by means of a continuous taper gib in contradistinction to set screws. Large work capacity is insured by a very wide and deep vise which is graduated throughout the complete circle upon a base that covers the whole table.

Lubrication is of the gravity type, being supplied by reservoirs in connection with all bearings. Felt wipers are so placed as to filter the oil as well as to supply the proper amount to the several bearings.

The machine is the last word in shapers by the American Tool Works Co. of Cincinnati. All gears are cut from the solid by special cutters; spur and bevel pinions being cut and planed from the steel bar. All shafting is of crucible steel and ground, and the whole is set up with the constant thought of rigidity, accuracy and durability.

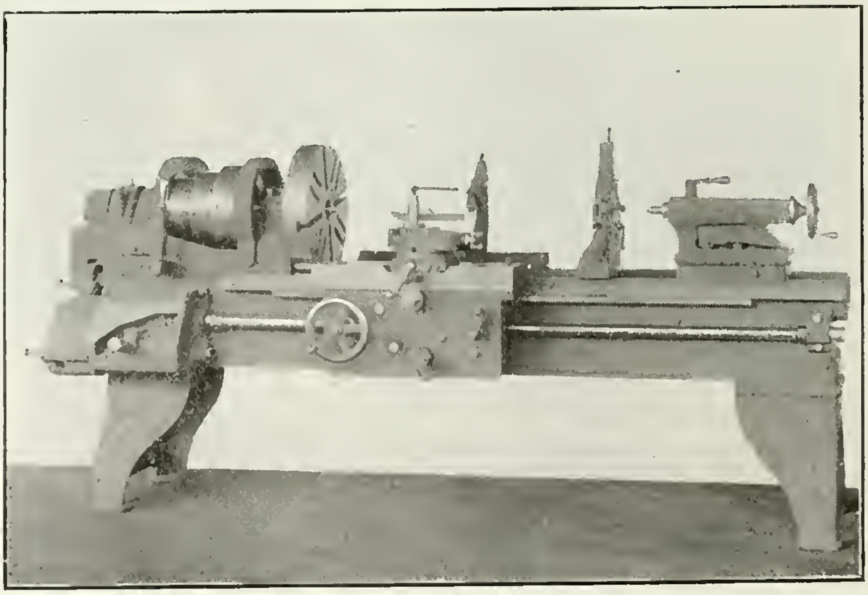
Regular equipments includes vise, countershaft, wrenches, safety stop and instruction book. There can also be equipped at extra cost: power downfeed, circular attachment, mold makers' vice, tilting top for box table, universal table with tilting side, gear box and single pulley electric drive.

18-INCH QUICK-CHANGE GEAR ENGINE LATHE.

The 18-inch quick-change gear engine lathe, which we here describe and illustrate, is a product of the Cincinnati Iron and Steel Co., Cincinnati, Ohio. It is claimed to be the heaviest and most powerful 18-inch engine lathe manufactured, an 18 x 8 weighing 3,500 pounds, and 170 pounds extra for each foot of bed.

The lathe will swing $19\frac{1}{2}$ in., take $1\frac{7}{8}$-in. stock, and will cut threads per inch, 2 to 46 with 38 changes of feed. Particular stress may be laid on the bearings, which are $3\frac{1}{2}$ x $5\frac{3}{4}$ for front and 3 x $4\frac{1}{2}$ for those at the rear. In addition, all of these lathes are built with a 3-step cone and double back gear, the back gear being proportioned 10 to 1 and 3.17 to 1.

Simplicity of design and pulling power power are features of this lathe (Cisco), only two wrenches being required for each machine. All thread and feed changes are obtained instantly without removal of a single gear and stopping the lathe, it requiring only two pull-pins


18-INCH QUICK-CHANGE GEAR LATHE.

and tumbler in change gear box for the operation.

The apron is worm-driven, this being

accomplished by means of a steel worm gear and bronze worm. The apron is of double-plate type, giving back support to studs, while the half-nut lever cannot engage accidentally; and, with the non-interfering device, it is impossible to throw feed and half-nut in at the same time. Ample oiling provision is supplied and compound rest and cross-feed collars are graduated.

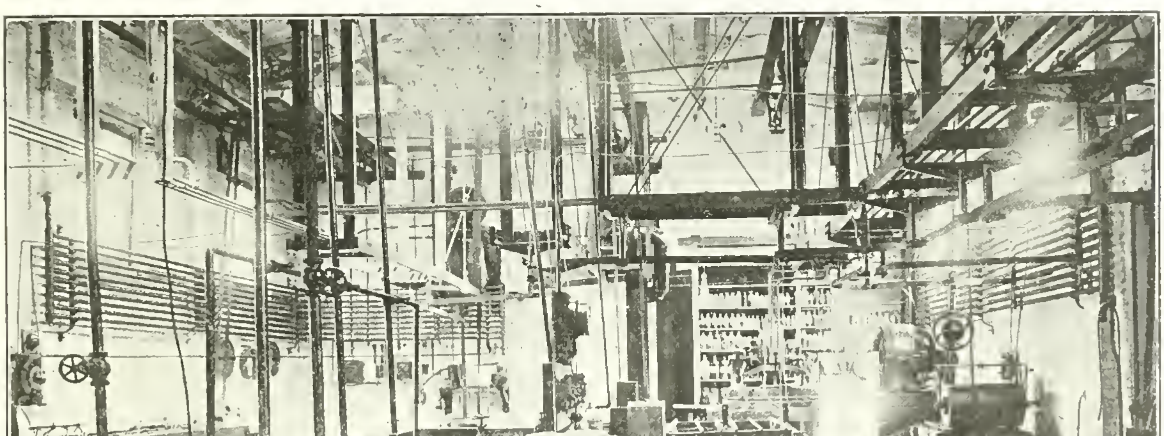
These machines are built in all lengths of beds from 6 feet up, and are designed for economical shop results.

MODERN ELECTRO-PLATING PLANT.

THE Canadian Hanson & Van Winkle Co., have recently installed in their Toronto works, a modern electro-plating and experimental plant for the use of their customers. The equipment is complete in every detail making it possible to give practical demonstrations in all classes of electro-plating, using the most modern methods known to-day. It has been designed and installed by W. H. King, plating expert of the Hanson & Van Winkle Co., of Newark, N.J. Electric current is supplied by a Hanson & Van Winkle generator set, the dynamo being directly connected by means of a flexible coupling to a suitable motor, with both units mounted on a sub-base. It might be said that it is of great importance to a plating installation to have in operation a motor generator set instead of having the dynamo belted from the regular shafting carrying other machinery, so that the plant can be run independently. In this instance a separate motor is employed for operating all other equipment, such as mechanical plating apparatus, polishing machinery, brush lathes, air compressors for lacquer outfit, etc.

A special feature is the use of mechanical devices for both polishing and plating, which reduce to a minimum the amount of handling of the work, thus materially reducing the cost of the operation. Mechanical plating has in recent years rapidly come to the front, which with the addition of the burnishing barrel has cut the cost enormously, and the special cleaning compounds which have been perfected in recent years for use either as electric cleaners or still solutions, have also helped to reduce the platers' troubles.

The heating of the plant has been carefully considered and has been so arranged that it can either be heated by steam from the main boiler or in case this is not in operation a special "Triumph" steam generator has been installed that can be put in service at short notice. When installing the steam fitting, great care has been taken to insulate all steam pipes in order to prevent leakage of the electric current. The installation is well worth a visit of in- Van Winkle Co. deserves congratulations for the efforts they have made to further the interests of the plating trade in Canada.



DEMONSTRATING PLANT OF THE CANADIAN HANSON & VAN WINKLE CO., Limited.

AMERICAN INSTITUTE OF METALS.

AN advance programme covering the 1914 Convention of the American Institute of Metals at Chicago, September 7-11, has been issued by the executive as follows:

Monday—Registration.

Monday Evening—Foremen's banquet, LaSalle Hotel.

Tuesday, 10 a.m.—Joint meeting with the A.F.A. Addresses of welcome.

Tuesday, 2 p.m.—Reports and A. I. M. papers. Both meetings on Tuesday to be held at the LaSalle Hotel.

Tuesday Evening—Programme open.

Wednesday, 10 a.m.—Joint meeting with A. F. A. Saddle and Sirloin Club. Cost congress. Papers and discussion.

Wednesday Noon—Ladies' luncheon at the Stockyards Inn.

Wednesday Afternoon — Stockyards inspection.

Wednesday Evening—Open.

Thursday, 10 a.m.—Saddle and Sirloin Club. Papers and discussion.

Thursday Noon — Ladies' luncheon, Marshall Field & Co.

Thursday, 2 p.m.—Papers and discussion. Election of officers.

Thursday Evening—Banquet at the LaSalle Hotel (for members only).

Friday, 10 a.m.—Last session.

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Vol. XI. JUNE 11, 1914 No. 24

PRINCIPAL CONTENTS.

EFFICIENCY IN THE OFFICE.

EVERYBODY is, at the present time talking and thinking "efficiency." How can the non-productive time of machines be eliminated? Could not that man run two machines instead of one? So much has been said and written upon this subject, it would seem that, as far as knowledge of efficient methods in the shop is concerned, we have reached a stage approaching perfection.

Much has been accomplished in cheapening machinery and manufactured products by increasing the efficiency of machines and operatives, but so far, efficiency as applied to the office staff has, for some reason or other, not been discussed.

The fact that the cost of marketing and selling certain articles is from one-third to one-half of the selling price would suggest in itself that a saving in the office end of manufacturing is something worth while. Here motion study would not only involve the manner of going about one's routine work, but could be applied to the planning of interviews, business trips and in many other ways.

By far the greatest saving in the office can be accomplished in its relations with the shop, where also a large personal element enters in. These two departments are often wasting energies on antagonistic contentions and strivings rather than conserving strength and good-will in co-operative effort. The fact should not be lost sight of that the office is part of an organization whose object is manufacturing and should accommodate itself to the attainment of that purpose.

It is in the office that a glib-tongued salesman can most easily sell an appliance for the factory that is not the best or most economical. It is here that sulphur coke is bought because it is cheap and it is there that accounts, accurate or inaccurate, invaluable or useless, are kept of cost, waste and savings. Unless efficiency and thoroughness pervade the office, the desired results of study in other departments are largely lost to the organization.

STEEL VS. MALLEABLE IRON.

WE notice throughout the manufacturing industries of this country, a decided movement towards the substitution of formed steel for malleable iron parts. This is taking place principally in connection with the production of implements and allied goods.

This form of evolution has been made possible by greatly increased and improved materials and facilities for making dies for bulldozers, drop hammers and particularly punch presses. Pressed steel is much stronger weight for weight than either cast or malleable iron and better resists almost every kind of wear except corrosion which, in most cases is preventable or unimportant.

As a large part of the raw materials in connection with the production of iron and steel is imported, the reduction of the quantity and cost of these materials is important from this point of view alone. Sheet steel, in many cases, costs a quarter less than cast iron weight for weight and is often less than half the cost of malleable. If we add to this the fact that but a fraction of the weight of formed steel is required to perform the same service, we can get some idea of the possibilities of this method of saving.

Canada is rapidly becoming a manufacturing and exporting nation and, in this connection, weight and bulk of products are often vital factors to be considered. The reduction in weight of seeding machines alone has been as much as 60 pounds and the repair parts have been reduced in a much greater proportion. The change, in most cases, has increased the strength, capacity and efficiency of the machines, and this added to the indestructible nature of the material requiring less crating, must be a considerable factor in making it possible for Canada to sell these manufactures to the rest of the world.

INDUSTRIAL NOTABILITIES--No. 38

WILLIAM ALLAN BLACK, vice-president and managing director, the Ogilvie Flour Mills Co., Ltd., Place Youville, Montreal: Mills Montreal, Winnipeg, Fort William, Medicine Hat and Seaforth; Director, Molsosn Bank; director, St. Lawrence Investment & Trust Co.; director, Home Investment and Savings Association; vice-president, Keystone Transportation Co.; managing director, Kaministiquia Power Co., Ltd., Fort William; and president, Manitoba Cold Storage Co., Winnipeg, was born at Montreal, Nov. 17, 1862, the son of Charles R. and Elizabeth (Hall) Black. The paternal ancestors were Scotch and the maternal English.

He was educated in the Public Schools of Montreal, and entered the Traffic Department of the Grand Trunk Railway, Montreal, in 1879. He transferred to the Traffic Department of the Canadian Pacific Railway Co. at Winnipeg in

WILLIAM ALLAN BLACK

1882, and joined the Ogilvie Flour Mills Co. in 1884; becoming secretary in 1887; general manager, Western Division, 1902; elected director, 1910; appointed general manager entire corporation 1911; and appointed vice-president and managing director, May, 1912. He is a member of the Grain Standard and Survey Board, and Member Council, Winnipeg Grain Exchange.

Mr. Black married Mary Campbell McEwan, daughter of Alexander McEwan, of Edinburgh, Scotland, in Portland, Me., April 29, 1890, and has two sons and two daughters.

His clubs are the Mount Royal, Montreal, Royal Montreal Golf, and Fort William (Fort William), while his chief recreation is golf.

He is Conservative in politics, Anglican in religion, and his residence is 735 Sherbrooke St. West, Montreal, Que.

—Photo, International Press.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 65
Lake Superior, charcoal, Chicago		16 00
Ferro Nickel pig iron (Soo)		25 00
	Montreal.	Toronto.
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 75	18 10
Victoria, No. 2X.......	18 50	17 85
Victoria, No. 2 Plain ..	18 25	17 60

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh............	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh..........	1.15
Beams and angles, Pittsburgh....	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	Cents.
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	Cents.
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

			Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...			$2 20	$2 20
Heads, per 100 lbs.			2 55	2 55
Tank plates, 3-16 in.			2 50	2 50
Tubes, per 100 ft.,		1 inch	9 50	9 00
"	"	1¼ in.	9 50	9 00
"	"	1½ "	9 50	9 00
"	"	1¾ "	9 50	9 00
"	"	2 "	8 75	8 75
"	"	2½ "	11 15	11 50
"	"	3 "	12 10	12 50
"	"	3½ "	14 15	14 50
"	"	4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb. off
Nuts, Hexagon, all sizes..	4½ per lb. off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright ......85, 10, 7½, 10, 10 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off	
Wood screws, flathead, Bronze ....70, 10, 7½, 10 p.c. off	

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Gal.	Lapweld Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 75	$15 75
Electrolytic copper	15 50	15 50
Casting copper	15 25	15 45
Spelter	5 25	5 25
Tin	34 50	35 00
Lead	4 85	5 25
Antimony	8 50	8 50
Aluminum	20 00	19 00

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double...	60%
Standard	60 & 10%
Cut leather lacing, No. 1.............	

BELTING RUBBER.

Standard	60%
Best grades	30%

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28........	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright....	3.90	4.00
Apollo brand, $10\frac{3}{4}$ oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G. ...	4 30	4 65
Fleur-de-Lis, 28 B.W.G. ...	4 10	4 45
Gorbal's Best, No. 28......	4 40	4 65
Viking metal, No. 28......	4.00	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal. ..	0.24
Benzine, per gal	0.22
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled..............	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, June 8, 1914.—Business in this section continues very quiet, but present prospects, although a little backward just now, point to an opening in some channels in the near future. During the past week there has been quite a lot of buying in the concrete mixer line, and also some in the machine tools; but apart from this, there has been very little doing.

It is the opinion of some of the local men that there will be a much better feeling in the business world as soon as the Government vote the Canadian Northern the money which they have asked for. At present the railway companies are doing very little buying, and, although the general movement of freight has dropped off considerably from that of a year ago, it is thought that there will be some buying after this bill goes through, notwithstanding the existing conditions.

The Phoenix Bridge and Iron Works of Montreal have just issued some figures for the eleven months ending March 31st last. These show an increase of business over the corresponding period of last year, amounting to $67,390.

The National Trust Co. have started work on their new building, which is to replace the one which they have been occupying for some time past. At the present time there is quite a lot of work under way, both down-town and in the residential districts.

Metals.

There is still a continued weakness in the metal market, and prices remain the same as last week. It is thought in local circles that the price of pig iron has reached the bottom, it being even claimed by some that the present price has been agreed upon. There is a tendency to figure out now just what future requirements will be, and a number of firms are buying, or at least intend to buy their supply of pig for the remaining six months of the year. Up to the present there has been a steady demand, although in very small quantities; just sufficient to last about a month at a time. There is still a weak feeling in tin, and although there has not been any change in the quotation, the market continues dull.

Toronto, June 9, 1914.—Business conditions have not changed materially since our last report, and trade generally seems to have fallen into a groove. The favorable crop conditions should, however, have a stimulating effect and create a more optimistic spirit throughout the country. The period of depression through which the Dominion is passing will inaugurate an era of economy which will ultimately be beneficial to trade generally, and also to the individual. This era must precede a return to prosperous conditions. A period of industrial depression frequently compels many companies which are over-capitalized to pay the penalty, and in not a few cases reorganization is the result. This is beneficial rather than otherwise, for it eliminates the unsound concerns, improves the general tone of business and restores credit.

The C. N. R. deal is making satisfactory progress, and it is considered highly probable that the G. T. P. will obtain a bond guarantee for $16,000,000 for the completion of the mountain section of the road. When these outstanding questions are settled, the railways involved will no doubt come into the market for material. The report of the Ontario Railway Board on the Toronto Street Railway is out, and contains many important recommendations which, if they ever go into effect, will improve greatly transportation conditions in the city. Incidentally an expenditure of about $3,000,000 is involved. The city council have decided to submit to the ratepayers a by-law to raise $300,000 to purchase motor busses, to serve the outlying districts. The by-law will probably be voted on in July, and if carried will considerably improve transportation facilities in certain districts.

Steel Market.

Conditions generally in the steel market are unchanged; the little business that is being done shows no improvement. One feature, however, must not be forgotten. This condition cannot keep up indefinitely, and the longer it continues the greater will be the reaction. Anticipation of a business revival in the fall is becoming a factor in the situation, and will have an effect in improving the tone of the market. Reports from Sidney, N.S., are not bright. It is stated that the Dominion Steel Corporation have closed down their nail mill indefinitely, also the rod and bar mill, which will probably remain inactive for some time. It is also reported that the wire mill will close down shortly, and remain so for over a month. The official reason given is that the company is overstocked. The United States Steel Corporation orders at the end of May showed another heavy falling-off, which has been estimated at between 300,000 and 400,000 tons, or practically equal to that of April. Prices on plates, bars and shapes have weakened slightly on special specifications, but business promises to be better this month than in May.

Pig Iron.

Market conditions in pig iron are still very quiet, and will continue so until trade improves. Comparatively little cast iron pipe is being purchased; municipalities, like manufacturing concerns, are waiting for better times. Stocks are low, and when trade improves there is bound to be a big demand for pig iron. In the United States the number of furnaces in operation was reduced by 14 in

May. The decrease in production was due largely to the lessened activity of the steel works. A still further reduction in output is expected this month.

Machine Tools.

Business in machine tools is dull and shows little hope of a revival in the near future. It is reasonable to suppose that an improvement in this market will not be noticeable until business conditions generally show greater activity. Dealers are expecting the C. N. R. to be in the market for machine tools when the agreement with the Government is settled. The Michigan Central Railway have purchased a number of tools from a local dealer for their shops at St. Thomas, Ont.

Metals.

The general condition of the metal market shows an improvement, and a larger volume of business is passing, although orders are generally in small lots. Prices remain unchanged.

Ottawa, June 8, 1914.—Unless something unexpected turns up—and it is not improbable—this week will see the close of the session. It has not been a spectacular session of Parliament; the ordinary man would say it has been a more or less useless session. There has however been passed a great deal of useful and important lgislation.

It has been pre-eminently a railway session, the most conspicuous measure being the C.N.R. bill. Then there was the G. T.P. bill, which provides for a guarantee of $16,000,000 for the completion of the mountain section. The National Transcontinental Commission report was discussed a week, while Maritime members talked themselves hoarse on the Intercolonial Railway. There was also a debate on the Hudson Bay Railway, and to cap all, the new consolidated Railway Act was introduced. This, however, will be held over until next year. Altogether, railway matters were very much to the fore.

It has been an exceedingly important session from the standpoint of the business world, amongst the bills of special importance to commercial interests being the following:—

(1) Trust Companies' Act.

(2) Loan Companies' Act.

(3) Amendment to Criminal Code (Bill to prevent false real estate advertising).

(4) Bill to prohibit the use of white phosphorus in manufacture of matches.

(5) Tariff Bill.

(6) Bill to regulate the use of explosives.

(7) Amendment to Companies' Act.

(8) Bill to regulate cold storage firms.

(9) Bill to prevent adulteration of dairy products.

(10) Consolidation of Fishing Act.

These were the main measures and it is a pretty formidable array.

Next session promises to be equally as interesting from the standpoint of business interests. The bill to consolidate the Railway Act will see a big tight between rival interests in the railway committee.

The bill to amend the Insurance Act introduced this session goes over until next session, as does the Co-operative Credit bill, introduced by Hon. Arthur Meighen.

The bill to consolidate the Shipping Act, and the bill to amend and revise the Industrial Disputes Act, will also be taken up next session. The latter is a particularly important measure and of extreme importance to industrial interests.

Winnipeg, Man., June 6, 1914.—While business actually done in ironworking machine tools is almost nil, there is a fair demand for woodworking machinery. The John Arbuthnot Co., a large Winnipeg lumber firm, whose planing mill was burned during last winter, have rebuilt their plant, and equipped it with machinery, costing in the neighborhood of $200,000. Some second-hand machinery was installed. The new machines include a moulder, tenoner, mortiser, rip saw, buzz planer, etc. The order was divided between the Canadian Fairbanks-Morse Co. and the Stuart Machine Co. The latter company sold one or two boilers this week for buildings going up in the city, but little is doing in contractors' or machinists' supplies.

Building Permits.

The city has been compelled to put its foot down on the unusual publicity being given to building permits in Winnipeg. These have been soaring at a record rate towards the ten-million-dollar mark, and the city newspapers have been drawing attention to this fact with large headlines. Their intention evidently was to prove that industrially Winnipeg was ahead of other cities in building. As a matter of fact, it is pretty well understood that only a small fraction of the buildings for which permits have been secured re being erected. The result of all this publicity was to bring into the city an army of builders, carpenters, painters, plumbers, as well as unskilled laborers, many of whom eventually joined the ranks of the unemployed. By suppressing news regarding the building permits issued it is hoped to check this influx.

It is understood that H. Corse, machinist, who for many years kept the linotypes of the city papers in repair, is branching out into a more general business, and is in the market for a drill press, a gap lathe, and a power hack saw. He has moved his plant from Alexander street to larger premises on Ross avenue.

Metals.

W. C. Cox, the Winnipeg manager of A. C. Leslie, dealers in sheets and metals, Montreal, has just returned from a five weeks' trip to the coast, and reports a demand all over the West for better tinplate. He states that hitherto tinsmiths have been handed out anything that the jobbers had to offer, which was often of a very inferior quality. He found business poor as far as the Rockies and at Vancouver, but reports excellent conditions at both Victoria and Edmonton, Government work being in progress at the former city, and much railway work at the latter.

The Manitoba Bridge and Iron Works have the contract for the steel work on the new Parliament Buildings, but it is understood they are only fabricating the steel, the erecting being done by Thomas Kelly & Sons. The plant of the Dominion Bridge Co. is slack, some of the jobs having been sent East to keep the plant there going.

E. B. Plewes, a well-known agent for machine tools and supplies, says things have been slightly better since the beginning of the month. He expects to do considerable business in belting next month, as the retailers usually get in their supplies for threshers during July.

The Medicine Hat Pump and Brass Co., Medicine Hat, Alta., who increased their capital recently from $50,000 to $75,000, are contemplating making an addition to their plant, and will be in the market for new equipment. It is reported that they are contemplating manufacturing windmills.

The Alberta Foundry and Machine Co., Medicine Hat, Alta., recently built a sample threshing machine, and may start manufacturing them shortly on a large scale.

To give an idea of the condition of some manufacturing plants in the West, the case might be cited of a Winnipeg firm who set out eight months ago to manufacture dies for jewelers principally, and who are now endeavoring to dispose of their tools second-hand. Winnipeg is not ripe, even in the best of times, for this class of business, and it is not surprising to find this firm unable to find work to keep this machinery going.

Dudley Michel, of South Wellington, Vancouver Island, formerly of the Crow's Nest district, has been appointed instructor in "first aid to the injured" for the British Columbia Department of Mines, and in that capacity will visit both metal and coal mines and give demonstrations of and instruction in first aid work, following the course of the St. John Ambulance Association.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Sydney, N. S. — A pump and electric motor will be purchased for the waterworks.

Alvinston, Ont.—The Morwood Machine shop has been purchased by Mr. Patterson.

The Natal Light and Power Co. has been incorporated in Victoria, B.C., with a capital of $25,000.

Regina, Sask.—The Canada Metal & Steel Range Co., of Oshawa, Ont., will open a branch here for the sale of their product.

The British Columbia Waterworks Supplies, Ltd., has been incorporated in Victoria, B.C., with a capital of $25,000. Head office at Vancouver, B.C.

Fort William, Ont. — It is expected that the National Tube Works will begin operations in about two weeks. A satisfactory trial was made last week.

Kerrobert, Sask.—Ross & Hayne, of Regina, have decided not to go ahead with the scheme for building a plant here for making gasoline and electric lamps.

Electrical

Wallaceburg, Ont.—A by-law has been carried to purchase the electric light plant at a cost of $30,000 and establish a hydro system. The vote was 303 for, 13 against.

Windsor, Ont.—Niagara power will be delivered here by August 1. All the towers are placed, and installing of equipment is being rushed all along the line.

Brantford, Ont.—The Hydro-Electric Power Commission has been asked for a survey of a hydro radial from Tillsonburg to this town.

Tavistock, Ont.—The by-law for installing hydro-electric power was carried on June 5 by a majority of 112 votes, 150 votes being polled.

Bolton, Ont.—The council have appointed a committee to negotiate the purchase of the Bolton Light, Heat and Power plant. When the necessary arrangements have been completed, a by-law will be submitted to the ratepayers for their sanction to contract for a supply of Hydro-Electric power.

Brantford, Ont. — A hydro-electric radial from Tillsonburg to Brantford is the latest development in railway circles in connection with this city. Working in with the Township of South Norwich, Clerk J. A. Smith, of the Brantford Township Council has written to the Ontario Hydro-Electric Commission, asking for a survey of a hydro-electric radial from Tillsonburg to Springford, to Otterville, to Bookton, to Kelvin, to Scotland, to Oakland, to Brantford.

Municipal

Victoria, B.C.—The city council have decided to purchase a paving plant from Warren Bros.

Port Alberni, B.C. The town council are considering the question of spending $10,000 on extensions to the electric lighting plant.

Portage La Prairie, Man.—It is proposed to build a stand pipe with a capacity of $300,000 gallons. The cost is estimated at $15,000.

Cardston, Alta. — A by-law will be voted on by the ratepayers on June 15, to sanction the expenditure of $11,000 on a gravity system of water supply.

New Toronto, Ont.—Council on June 1, passed a by-law to provide for the issue of general debentures for $27,000 to construct waterworks and purification plant. James Loudon & Hertzberg, Toronto, are the engineers.

Hanover, Ont.—By a majority of 85 a by-law to authorize extension of the town waterworks system, the purchase of a site and the erection of a water tower, carried here on June 1. The expenditure involved is $10,000.

Wallaceburg, Ont.—George B. Moore, of Weston, has been awarded the contract for the installation of a water works and sewerage system for this town. Both systems are being laid together. The town will receive its supply of water from a branch of the Sydenham River.

Lloydminster, Alta.—At a ratepayers' meeting held recently it was resolved to petition the town council to proceed at once with the $15,000 fire protection scheme, cement sidewalks in business area, and to sink a deep well at once with a view to obtaining a supply for a complete waterworks system.

Brampton, Ont.—At the meeting of the town council held on June 2, the tender of the Northern Electric Co., for $3,139 for the installation of an electric fire alarm system for the town was accepted. The switchboard will be placed in the present fire hall and a tapper in the fire chief's office and also in the Dale Estate offices.

Point Grey, B.C.—A by-law to authorize the Richmond Council to raise $40,-000 for the extension of the municipal water service to the outlying districts is at present being prepared, and is expected to come before the council for consideration at the next regular meeting. The by-law will probably be submitted to the electors this month.

Peterborough, Ont.—The matter of the local disposal plant being erected in Otonabee Township is being held up pending a report which the provincial board of health is preparing regarding the location of the plant. The report will be submitted to the township, for which E. A. Peck is acting, after which the township will be permitted to offer its objections to the locating of the plant on township land.

Toronto, Ont.—The tender of the John ver Mehr Co., of this city, to construct a Ransome drifting sand filter of 60,000,-000 gallons a day capacity at the Island, has been accepted by the city council, with a vote of 15 to 1, on June 9. The filtration plant is to cost $1,066,282, and is guaranteed with a cash bond of $250,-000 to produce tasteless, colorless water, 98 per cent. bacteriologically pure, and to require not more than one grain of chemical per gallon for the treatment.

Calgary, Alta. The aldermen have decided to re-submit several of the bylaws which were defeated by the ratepayers in April and, in addition, a new bylaw making a grant of $360,000 to the Exhibition Company, for the erection of new buildings, improvement of grounds, etc. The bylaws to be resubmitted are as follows:—Parks, $50,000; electric light, $300,000; concrete sub-base for street railway, $90,000; publicity and receptions, $17,000. The total expenditure asked to be authorized is $807,000 and the five bylaws will go to the people on June 26 next.

Winnipeg, Man. — Seventy-four in favor and twelve against was the outcome of the voting in the rural municipality of Fort Garry on the bylaw authorizing the raising of $40,000 to provide for the construction of a distribution plant for a supply of electricity. A contract for obtaining the current has already been made with the Winnipeg Electric Railway Co., but the agreement was, however, conditional upon the passing of the bylaw. The council are now in a position to give the bylaw its third reading and proceed with the work.

Owen Sound, Ont.—By a majority of nearly five hundred, the by-law to grant the bonus of $10,000 yearly for twenty years for the construction of a shipyard and drydock was carried last Saturday by the ratepayers. An expenditure of $1,500,000 has been granted. Almost every available vote was polled. The by-law to guarantee the bonds of the Union Cement Co. was carried by some 200 votes. The bonds will be guaranteed to the extent of $60,000. Nearly four hundred votes carried the by-law giving the Canadian Yeast Co. exemption from taxation and supplying water for their use.

Toronto, Ont.—A by-law asking for permission to spend $300,000 on motor buses will be submitted to the people during the second week in July. This was decided at a private meeting of the Board of Control on June 4. Council will probably be asked to give two readings to the bill at the meeting to be held on June 15. It was decided that 35 buses will be required to satisfy the needs of the residents in North and West Toronto, but an initial purchase of ten will be made. English and American firms will enter the competition for supplying the vehicles.

General Industrial

Thorold, Ont.—Mr. Jas. Battle turned the first sod at Thorold on June 8, for the new Exolon factory about to be erected.

Kingston, Ont.—At the annual meeting of the North American Smelting Co. J. B. Reid, of Alexandria Bay, was re-elected president; W. G. Craig, vice-president, and S. J. Driver, secretary-treasurer.

Hagersville, Ont. — The mill and bakery owned by R. J. Rank were destroyed by fire on June 3. The damage to the mill is estimated at $25,000 and to the bakery $5,000. Both were covered by insurance.

Chatham, Ont.—The Board of Health has decided to purchase a pulmotor for the city. This decision was reached after a special committee had thoroughly investigated the question and members of the board had seen several demonstrations. The machine will be placed in the fire hall, which is centrally located, and opened at all times. The members of the department will be instructed in its operation.

Listowel, Ont.- The local ratepayers were to have voted on May 30, on a bylaw authorizing a loan of $10,000 to the Dominion Milk Flour Manufacturing Co. The promoters, however, at the eleventh hour had the by-law withdrawn, fearing its defeat, as the town was favorable to a counter-proposal, that of the Libby, McNeil Co., of Chicago, who offered to locate a big condensed milk factory here if the town would provide interswitching facilities between the Canadian Pacific and Grand Trunk Railways. As this has been arranged, the Chicago firm will probably locate here.

Galt, Ont.—A carload of machinery consisting of boiler, drills, cables, derricks, etc., has arrived and will be used in drilling for oil on Alex. Neubauer's farm in Puslinch, near here. If the venture meets with success there are other farms similarly situated upon which wells will be sunk. These farms give every evidence of oil, and experts who have looked over the ground are very hopeful of the venture. In places on Mr. Neubauer's and John Eckert's farms the oil is to be found in small quantities floating on the surface of the water.

Montreal, Que.—Plans have been already completed and construction will start in a few weeks on an additional plant for the Jas. Strachan Bakery. The cost of building and equipping the new bakery will run into almost a quarter of a million dollars and when completed it is claimed the bakery will be the most modern in Canada. The ovens are now being made by Jos. Baker & Sons, of London. England. All of these are traveling ovens of the most improved design and when installed are entirely encased with white enamel tiling. The largest of these ovens is over 90 feet in length and 15 feet wide.

Fort William, Ont.—A rumor has been circulating for some time past here that the well known Armour Grain Co., of Chicago, were considering the installation of an office and perhaps a new elevator at the head of the great lakes. The company, which is one of the largest in the States, opened an office in Winnipeg recently, and it is regarded as almost certain that an office will be established here in the near future. A member of a well known local grain firm stated that in his opinion, the Armour Grain Company would have an office and very probably an elevator in Fort William inside of a year's time.

Regina, Sask.—The city council has sanctioned the sale of the civic warehouse to the Canadian International Light Co. for $22,000. As a result of this action the city secures a new industry which will employ at least 26 men the first year, and gets rid of a building which has been more or less of a white elephant even since its construction. The Canadian International Light Co. will be incorporated with a capital of $150,000, a substantial proportion of which is being subscribed by prominent local men. A plant valued at $30,000 is being brought from Chicago and will be installed at the earliest possible date. The company will manufacture kerosene, gasoline and coal oil lamps and smoothing irons. Ross and Haynes are interested.

Railways—Bridges

Dunnville, Ont.—The ratepayers carried a by-law to raise $35,000 to purchase a right-of-way for the extension of the T. H. and B. Railway.

Gananoque, Ont.—A by-law will be voted on by the ratepayers on June 12, to authorize the payment of a bonus of $25,000 to the Gananoque & Arnprior Railway Co. for the construction of certain lines.

London, Ont. — Announcement has been made that the London Street Railway have decided to purchase from five to ten new cars for the local service. The purchase is left in the hands of Manager C. B. King, Vice-president T. H. Smallman and Director W. M. Spencer.

Brampton, Ont.—If the G.T.R. fail to inaugurate proper suburban service to Toronto, the citizens of Brampton intend to build a 12-mile road of their own to Islington, where connections can be had with the C.P.R. The latter road have promised to operate the new line and hand over to the citizens forty per cent. of the receipts. The present C.P.R. line between Toronto and Brampton is too long for a suburban service.

Eganville, Ont.—The old bridge at the foot of Golden Lake on the Bonnechere river, eleven miles west of here, is being removed preparatory to the erection of a new one at the same point. The new structure will be of concrete and steel and will cost in the neighborhood of $6,000 or $7,000. The County will pay $1,000 towards the erection of the new bridge, the Dominion Government, $1,000 and the remainder of the cost will be paid by the Provincial Government.

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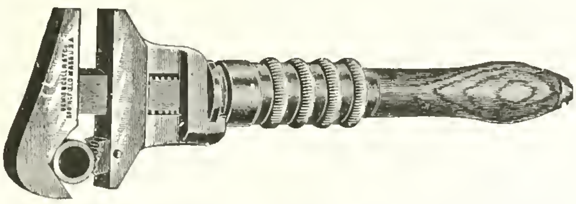


"Bemis & Call"
Combination Wrench

for Pipe or Nut work and highly efficient in either capacity

The general utility and all-round convenience of this combination has no equal.

It is a wonderful time-saver.

Thoroughly case-hardened, and all parts are interchangeable.

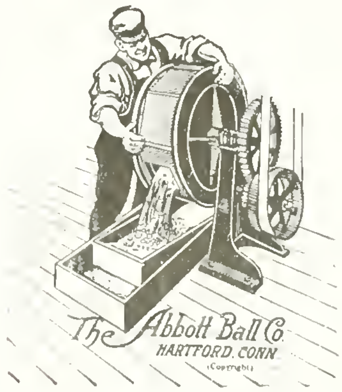
Send card for complete catalogue on wrenches.

Bemis & Call Hardware & Tool Company

Springfield, Mass., U. S. A.

Let this Barrel Do Your

BUFFING AND BURNISHING



The metal goods that you are now buffing and burnishing by hand can be equally as well done with

Abbott Carbonized Steel Balls

in an Abbott Burnishing Barrel. In large quantities and with unskilled labor. Ask Us How. We Like To Tell About It.

THE ABBOTT BALL COMPANY

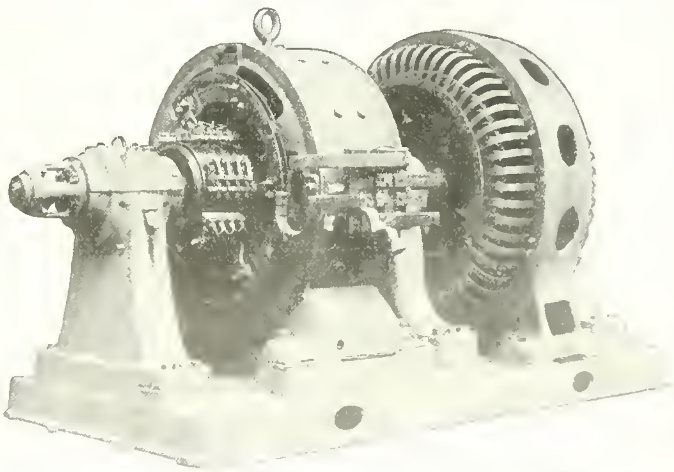
1047 Elmwood Avenue, Hartford, Conn.

CANADIAN AGENTS: The Chapman Double Ball Bearing Company of Canada, Limited, Toronto, Canada

The thoroughly successful performance of

Westinghouse Synchronous Motor-Generator Sets

is due to the fact that they have been designed after a careful study of power requirements, and long experience in the application of electrical apparatus. Some of their advantages are:



100 Kw. Westinghouse Self-Starting, Synchronous Motor-Generator.

Sparkless commutation over a wide range of load and overload.

High efficiency at all loads, particularly on fractional loads.

Simplicity combined with ruggedness.

Minimum attention required.

High power factor at all loads.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

TORONTO	MONTREAL	OTTAWA	HALIFAX	WINNIPEG	CALGARY	VANCOUVER
Traders Bank Bldg.	52 Victoria Square	Ahearn & Soper, Ltd.	Telephone Bldg.	158 Portage Ave. E.	Grain Exchange Bldg.	Bank of Ottawa Bldg.

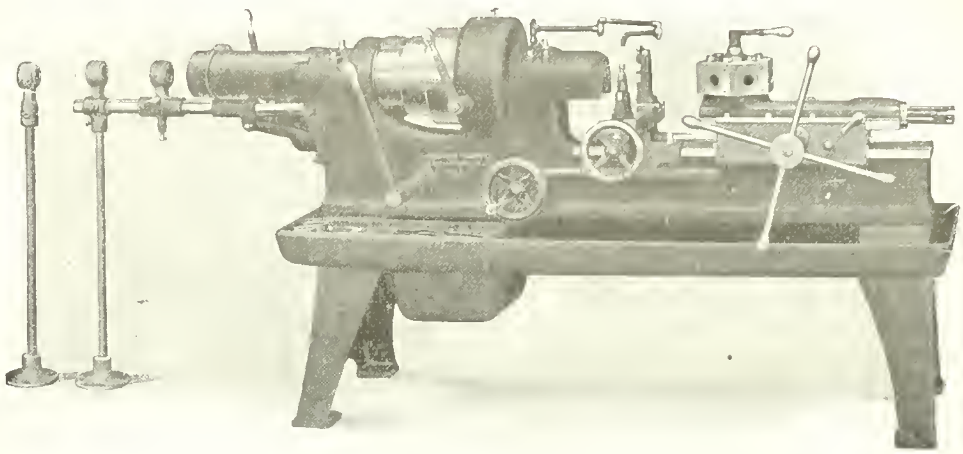
WARNER & SWASEY TURRET LATHES

Types and sizes for every requirement—Bar and Chucking work.

For the most exacting requirements of modern manufacturing methods.

Every modern facility provided for rapid, accurate, economical production.

Turret Lathe equipment planned and estimates of output furnished



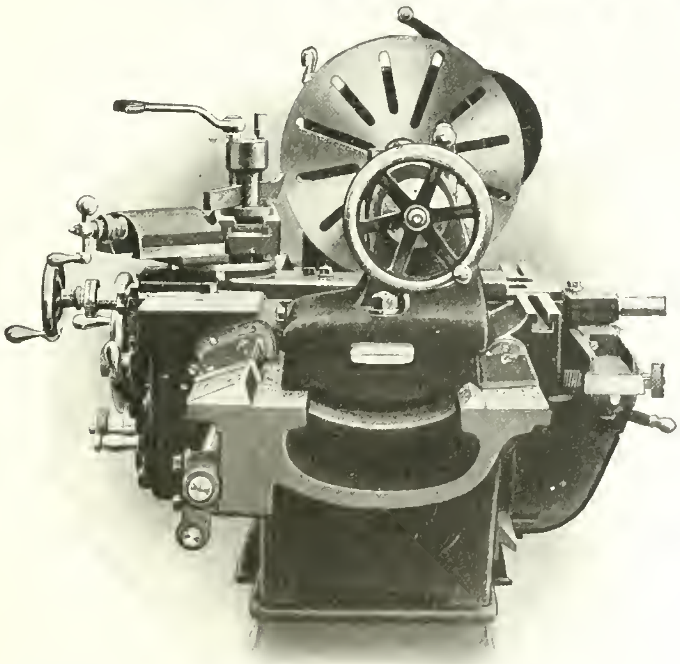
No. 6 Turret Screw Machine
Five Sizes—$\frac{3}{8}$ to $3\frac{5}{8}$ inch Bar Capacity; 10 to 20 inch Swing

THE WARNER & SWASEY CO., Cleveland, Ohio, U. S. A.

UNIVERSAL HOLLOW HEXAGON TURRET LATHES—TURRET SCREW MACHINES—BRASS-WORKING MACHINE TOOLS

Canadian Agents: A. R. Williams Machinery Co., St. John, Toronto, Winnipeg and Vancouver, and Williams & Wilson, Montreal

LeBlond Heavy Duty Lathes



End view of H. D. Lathe

Are especially adapted to the heaviest kind of manufacturing and modern high-speed production. They are not the regular type of lathe dubbed heavy duty, but machines designed and built for just this kind of work.

WRITE FOR DETAILS

The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio

Canadian Agents—The A. R. WILLIAMS MACHINERY CO., Toronto, Montreal, Winnipeg

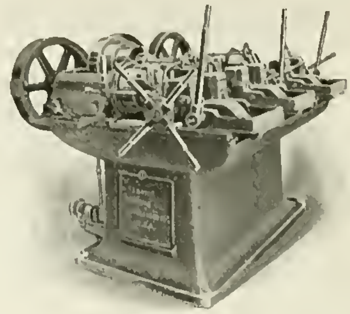
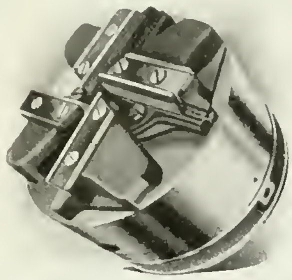


Figure for Yourself, Mr. Shop Superintendent

The monetary value of the increase in output and the decrease in maintenance and labor costs characteristic with the **LANDIS DIE.**

The line contact the chaser has with the work eliminates most of the friction at the cutting edge and makes it possible to operate at a speed from 50 to 100% greater than that possible with any other die.

The length of the chaser, the interchangeability of the chasers, and the right and left-hand threading features mean an enormous saving in maintenance cost.



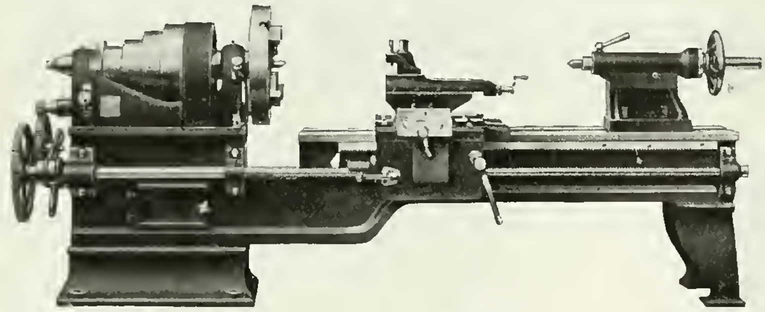
The simple grinding operation at the front end of the chaser and the absence of annealing, hobbing and retempering mean a reduction in non-productive labor.

Write for Catalogue No. 21.

LANDIS MACHINE COMPANY

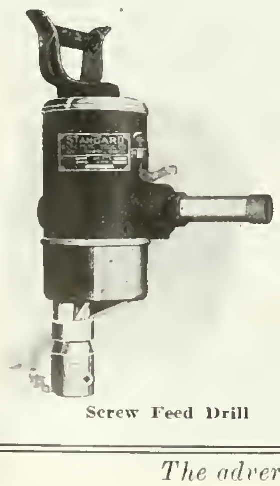
WAYNESBORO, PA., U.S.A.

Exclusive Canadian Agents: Williams & Wilson, Limited, Montreal, Canada



High-Class Self-Acting Screw-Cutting and Surfacing Lathes.

C. F. DITTES, Ltd., Machine Tool Engineers, Werdau-in-Saxony, 14.



Screw Feed Drill

"HIGH POWER" Portable Electric Drills and Grinders

Will operate on both Direct and Alternating **60 Cycles or less. Ball-Bearing throughout.**

They stand in a class by themselves for quality, design and usefulness.

A TRIAL IS ALWAYS CONVINCING. Write for catalog, and then order the size you need.

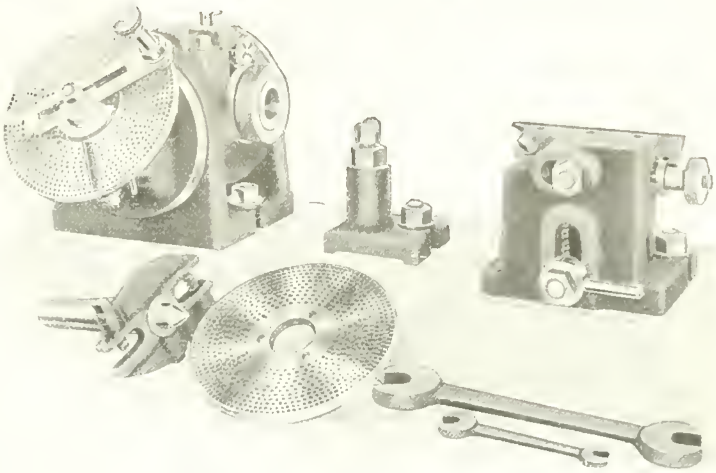
THE STANDARD ELECTRIC TOOL CO.

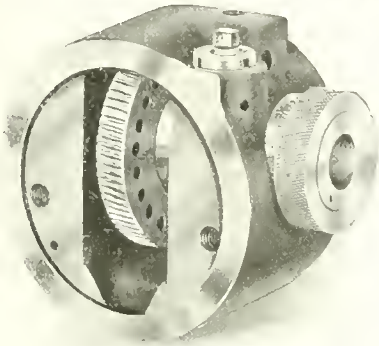
CINCINNATI, OHIO, U. S. A.

Ball-Bearing Bench Grinder.

THE

KEMPSMITH UNIVERSAL DIVIDING HEAD





The WORM WHEEL is located centrally on the spindle, between the front and rear bearings, strictly within the head proper. Its position and very large relative size are here shown. It is $5\frac{1}{4}$ inches in diameter on the 10-inch size Head, and $6\frac{1}{2}$ inches on the 13-inch size. How do we get it? Write us for description of this wonderful new Head. Regularly furnished on all our Universal Milling Machines—also separately.

Kempsmith Mfg. Company **Milwaukee, Wis.**

AGENTS: Western Canada: Western Supply & Equipment Co., Calgary; Stuart Machinery Co., Winnipeg. Ontario: General Supply Co., Toronto and Ottawa. Quebec: Canada Machinery Agency, Montreal.

A MODERN SAVER

of Time, Money, Space and Labor

Here is a machine that is well worthy of your attention—our **"Double C Punch and Shear"** with 48-inch throat.

This machine has an enormous capacity for doing **rapid, accurate** and **economical** work of **quality**.

Let us send full description. If you are interested in up-to-date money-saving machinery you cannot afford to remain uninformed.

We manufacture a complete line of

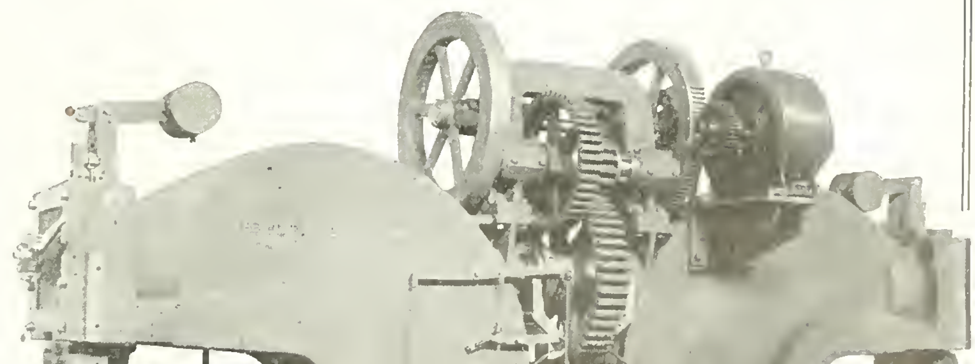
LABOR-SAVING MACHINERY

all kinds and sizes, for

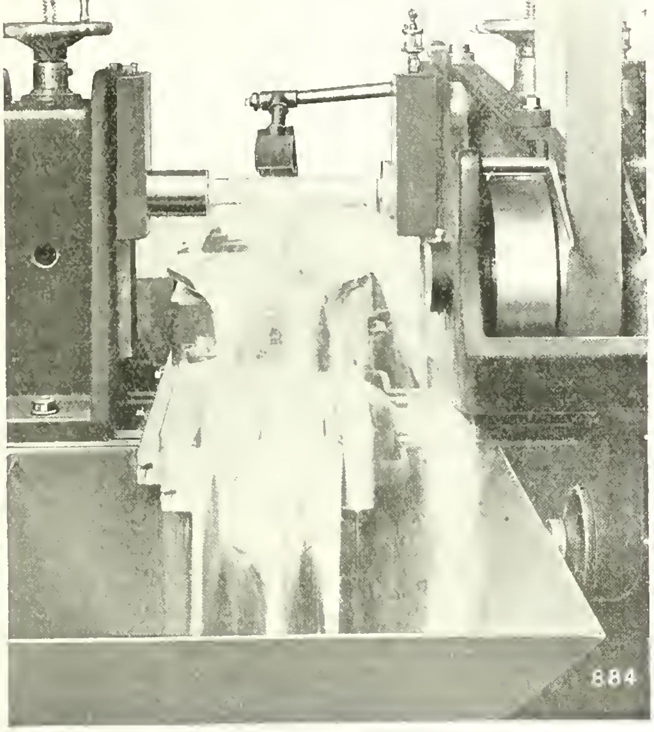
Structural Iron Works, Railroad and Locomotive Shops, Boiler Shops, Rolling Mills, Agricultural Implement and Plow Shops, etc.

The Long & Allstatter Co.
HAMILTON, OHIO

Canadian Representatives
RUDEL-BELNAP CO.
Montreal, P.Q. Toronto, Ont.



Stream Lubrication



Stream Lubrication on Cincinnati Semi-Automatic Miller: Hood lifted away from cutter to show construction.

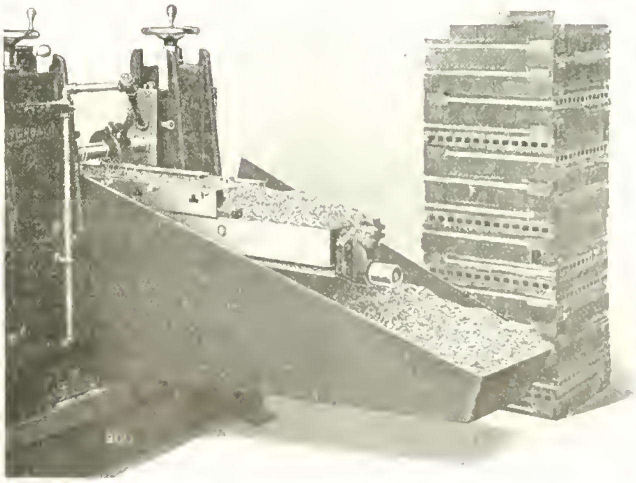
The Cincinnati Stream Lubrication, or Cutter and Work Cooling System (patented), enables us to mill in actual practice three to five times faster than has before been possible.

The essential factor is the hood. This retains the lubricant around the cutter, forcing it to run in an inverted bath completely cooling every part of it. This device is patented.

The rush of lubricant from the hood washes away the chips so that they neither clog the cutter nor mark the milled surface. The cleaning of the jig or vise is thus reduced to a minimum with a corresponding saving in chucking time.

Send us blueprints of your work and we will show you how this new feature will reduce your milling costs.

A copy of "Cold Chips" is yours for the asking.

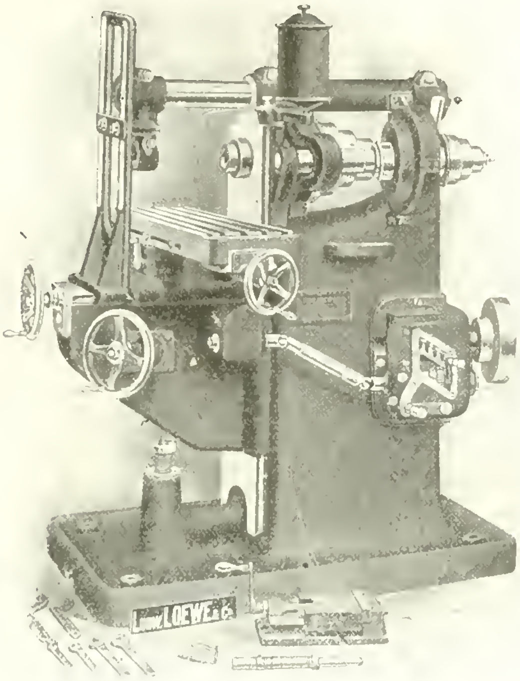


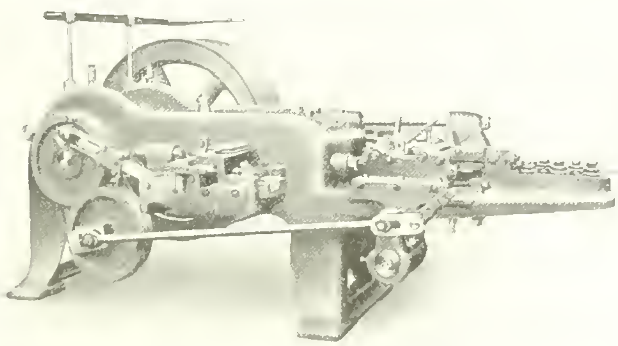
ACTUAL PRACTICE
5" Diameter Cutter, Speed 150 r.p.m., Feed 11", Slots ¾" wide—1½" deep Machinery Steel.

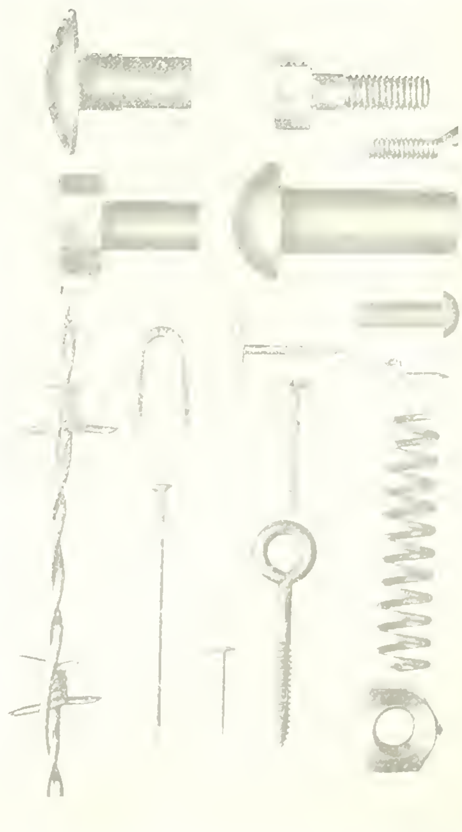
CINCINNATI MILLING MACHINE COMPANY

CINCINNATI, OHIO, U. S. A.

CANADIAN AGENTS: H. W. Petrie, Limited, Toronto, Montreal. Taylor & Young, Vancouver.



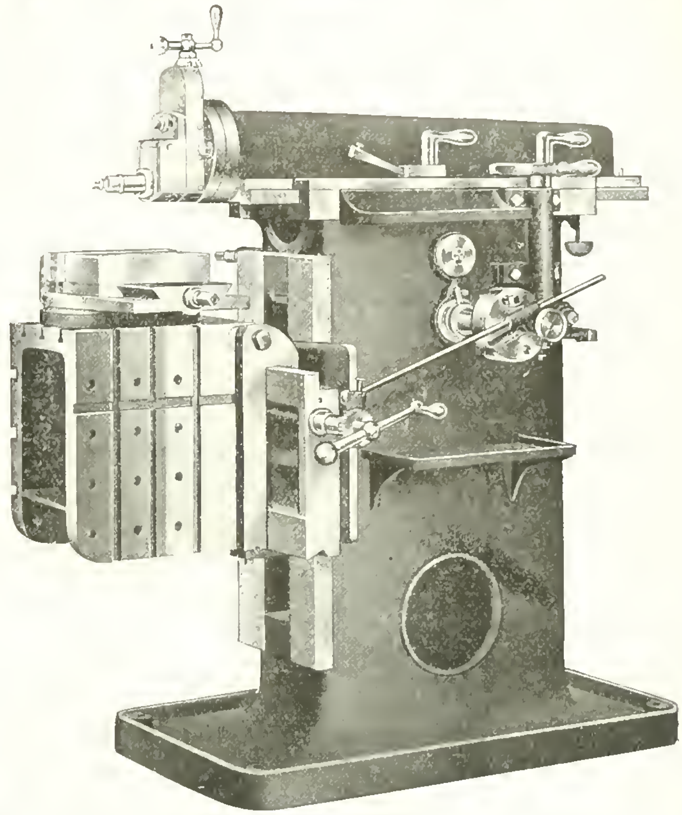




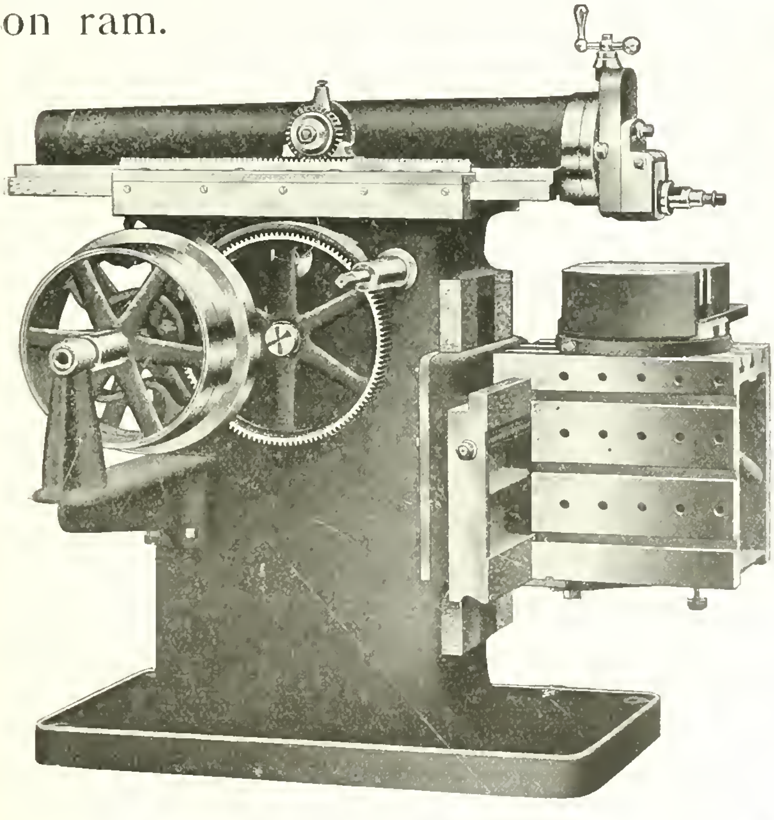
HENDEY Friction Clutch Driven SHAPERS

Will plane to a line.
Ram is driven by double train of gearing, giving

Constant Speed
Constant Power
Full Length of Stroke.



Stroke of ram can be quickly changed to any length and position while in motion, simply by removing reversing dogs to necessary position on ram.



Micrometer adjustment on cutting stroke for fine variation in length of forward travel.

Made in 15-in., 20-in., 24-in. and 28-in. stroke.

24-in. and 28-in. shapers have power-down feed.

The Hendey Machine Co.

TORRINGTON, CONN., U.S.A.

Canadian Agents: A. R. Williams Machinery Co., Toronto, Ont.; A. R. Williams Machinery Co., 260 Princess St., Winnipeg; A. R. Williams Machinery Co., Vancouver; A. R. Williams Machinery Co., St. John, N.B.; Williams & Wilson, Montreal.

"Stood the Toughest Tests On the Hardest Steel"

That's what users say regarding Detroit Drills and you'll say the same after a good stiff test.

The Studebaker Corporation has increased its drilling efficiency on one job from an average of five holes without a grind to nearly sixty—twelve times!

"Detroit Special" Twist Drills

tested by this same corporation, made the following record: At high speed in drop-forgings or nickel alloy steels they drilled from 50 to 100% more holes than any other make of drill entered in competition. In addition, there was a saving of from 15 to 20% in power.

With the testimony of actual results like this before you, can you afford not to give "Detroit" Twist Drills and other small tools a trial?

Write our special Service Department; let them analyze your drilling conditions and make suggestions. No obligation to you if you're not satisfied.

So certain are we that "Detroit" Drills will give *you* the best drilling service you have ever known that we offer to send you some on trial and refund the purchase price for any which fail to bear out our claims.

Write to-day for that trial order and ask for Catalog R.

Trade Mark

Detroit Twist Drill Company

Detroit Michigan

SOLD BY

Trade Mark

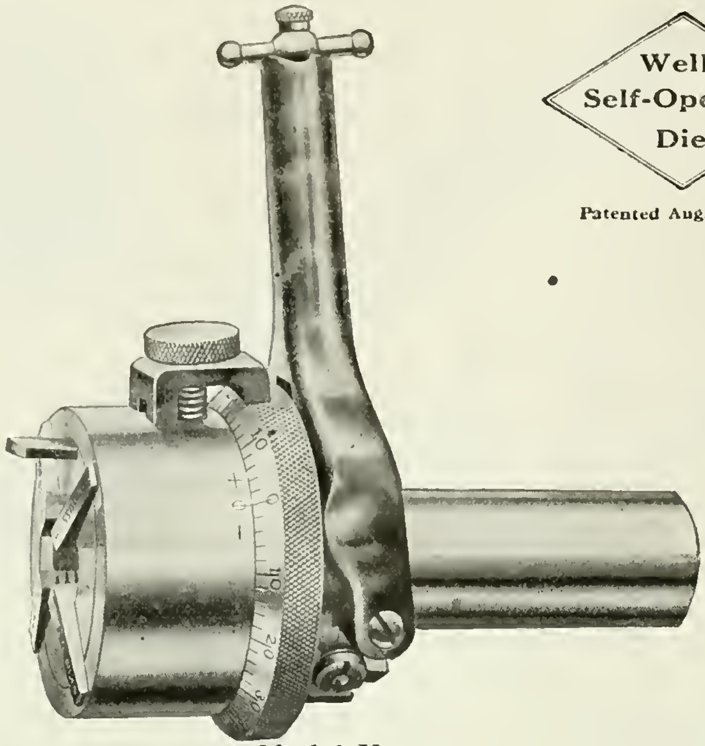
E. B. Plewes, 120 Lombard St. Winnipeg—Man.

The Foss & Hill Mchy. Co., 344 St. James St- Montreal—Que.

Walkerville Hardware Co., Walkerville—Ont.

458

A New Record for Dies



Wells Self-Opening Die

Patented Aug. 2, 1910.

Model V

While still in its experimental stage

204 Wells Self-Opening Dies (Model V) were placed on trial among various machine shops of the United States, Canada, England and Germany—a large portion being put to work under conditions where other automatic opening dies had "fallen down" absolutely. Out of those 204 dies, 197 made good in every respect and are in operation to-day, giving fine satisfaction; to say nothing of the subsequent hundreds that are now in daily use.

Saves its Cost in a Week

Because

It can be operated at higher speed than any other type of screw-cutting die.

It saves the lost motion and time of "backing off" the work.

It saves wear and tear on machinery and transmission (due to reversing).

It produces more uniform work—prevents defective work—simplifies inspection.

It is adapted to a wide range of machines, working conditions and metals.

Changes from one cutting size to another are made in a minute.

The most intelligent and economical little steel workman that ever entered a shop.

Sole Manufacturers

Wells Brothers Co., Div.

Greenfield Tap and Die Corporation

GREENFIELD, MASS.,

Makers of the famous *Little Giant* Line of screw-cutting tools and machinery.

New York Store..............107 Lafayette Street
Chicago Store .... 13 So. Clinton Street
London Store .... 149 Queen Victoria Street

The **Screw Thread** is an ingenious mechanical device of unknown origin:—a wonderful convenience if accurately cut—a miserable nuisance if not.

The **Wells Self-Opening Die** is a strong, rugged threading tool of simple mechanism, producing the accuracy of lathe-cut threads at twice the speed of ordinary dies.

Full information on request.

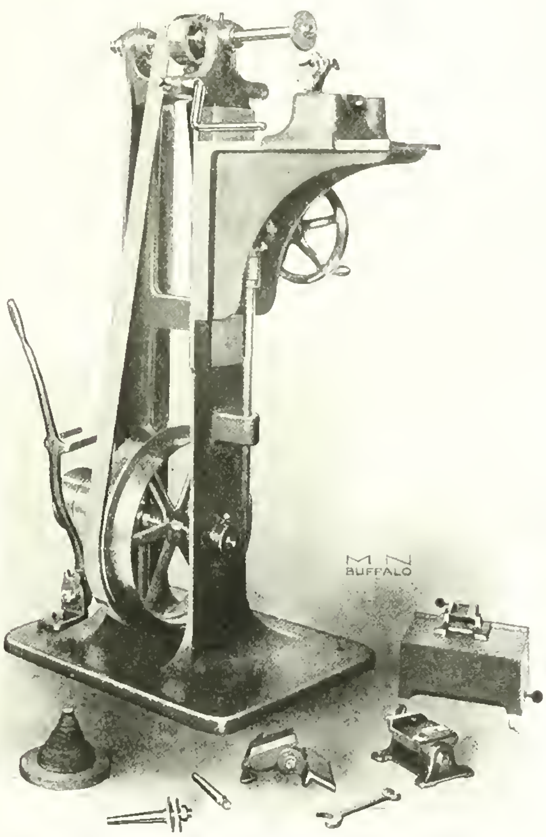
or

WELLS BROTHERS COMPANY of CANADA, Ltd., GALT, ONT.

"Modern" Chaser Grinders

Your attention is called to the remarkable saving that is possible with the machines illustrated herewith.

"MODERN" CHASER GRINDER
(BELT DRIVEN)

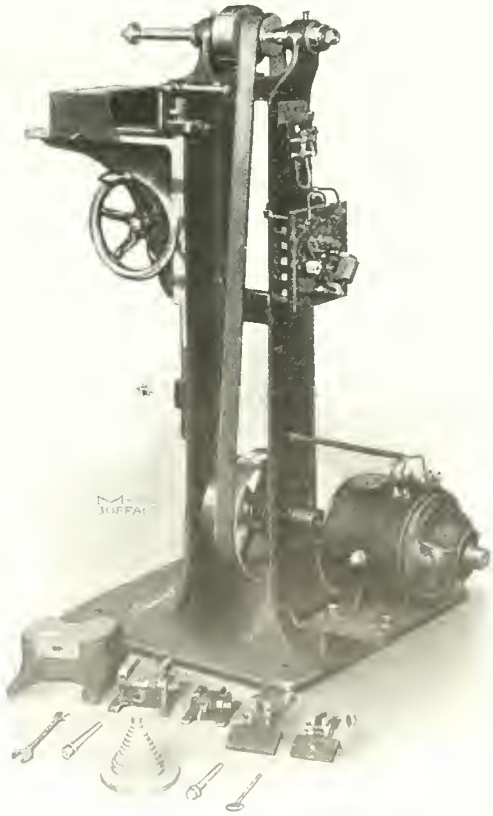


Machine Showing Full Equipment

The "Modern" Chaser Grinder must command your interest if you are using threading dies. We say this is the "most useful machine ever built" advisedly, and believe that you will agree with us in this statement after you have considered the distinctive features and advantages of the "Modern" Chaser Grinder.

Its economy will be quickly appreciated when consideration is given to the amount of time wasted in grinding your Chasers by hand. It is easier, quicker and better to grind your cutting dies and chasers with a "Modern," as ninety per cent. of the die troubles encountered are caused by incorrectly ground chasers; then, your wasted time is saved and production is increased, and at the same time your threaded work is accurate and uniform.

"MODERN" CHASER GRINDER
(MOTOR DRIVEN)



Machine Showing Full Equipment

Wherever this Machine has been installed, it has resulted in an enormous saving of time over previous methods of grinding chasers.

If you are interested in reducing the cost of Chaser grinding, it will pay you to investigate the merits of the "Modern" Chaser Grinder.

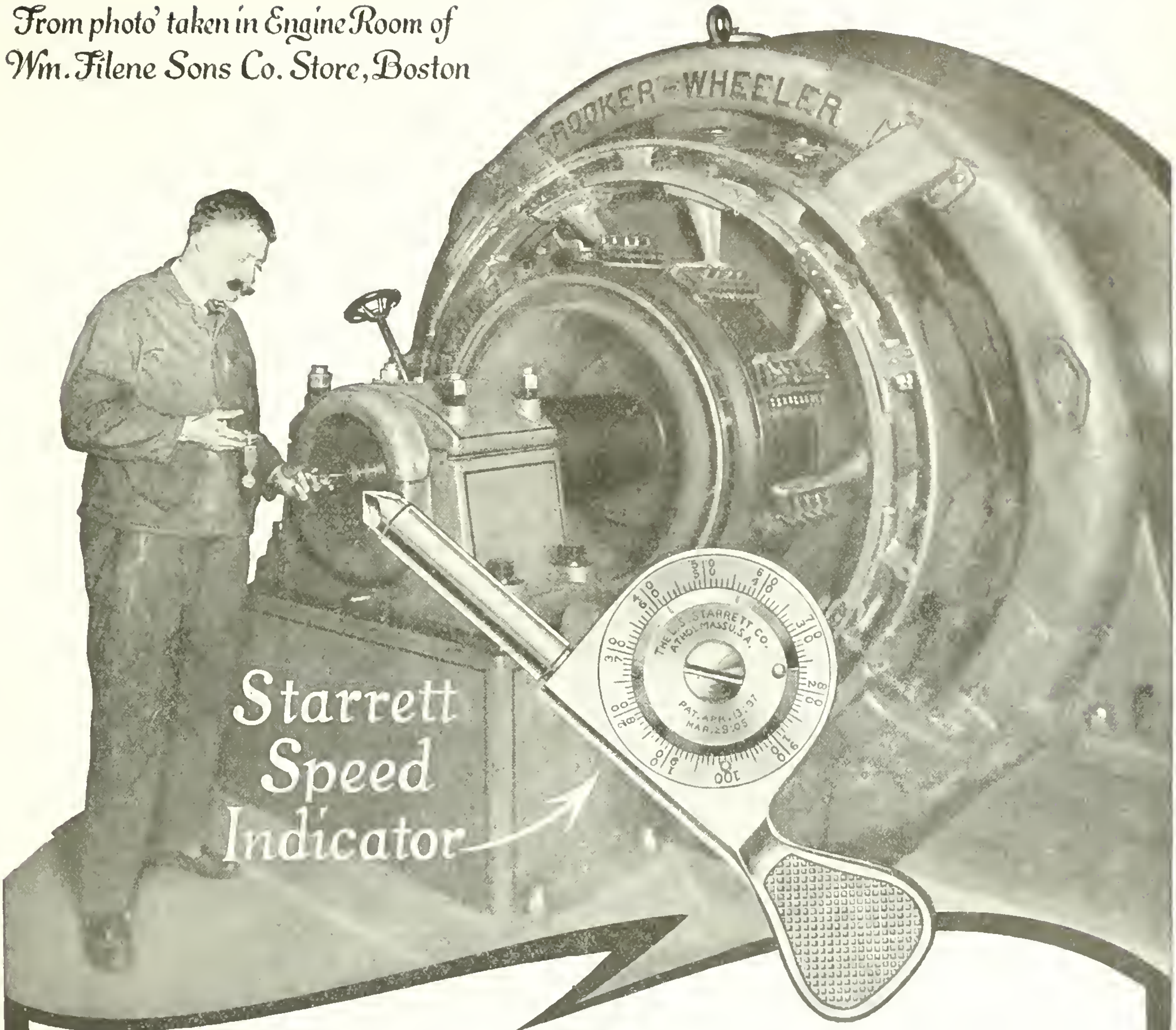
The "Modern" Chaser Grinder is adapted for grinding chasers for any style or make of die and is equally efficient in grinding bolt die chasers. We also furnish a number of special fixtures with this machine, by the use of which Spring Dies, Pipe Dies, Spiral and End Mills, Milling Cutters, Hobs, Reamers and Taps may be successfully ground.

This machine is simple in construction, inexpensive to maintain, easy to operate and it will save much valuable time in the grinding of your small tools.

MODERN TOOL COMPANY

State and Peach Streets — Erie, Penn'a, U. S. A.

From photo' taken in Engine Room of Wm. Filene Sons Co. Store, Boston



Every Mechanic Should Have a Starrett Speed Indicator

Men who work about machinery should have this indicator for taking speed on engines, generators, turbines, motors, line shafting, grinders, etc. It is the simplest, most accurate instrument made. It is especially valuable in taking speeds when computing engine horse power, etc. With the rubber wheel attachment it may be used to figure surface speeds. It indicates highest speed without heating. The parts are enclosed like a watch.

Made in three styles, prices $1.00, $1.50 and $3.00.

Send for catalog No. 20З to make your selection.

Buy Starrett Tools at any good hardware store.

The L. S. Starrett Co. Athol, Mass.

World's Greatest Toolmakers

If you don't know the LIGHTNING Tap

Send for this little book which describes its salient features.

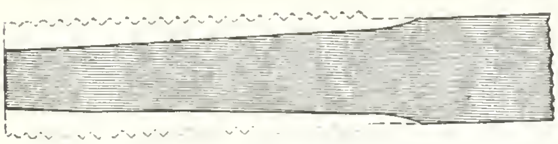
The LIGHTNING (Trade Mark) Tap stands pre-eminent in the mechanical world—a monument to the creative ability, perpetuating power and progressive ideals of the Wiley & Russell organization.

The only Tap considered good enough to imitate.

IF A BETTER TAP IS EVER MADE **W. & R.** WILL MAKE IT.

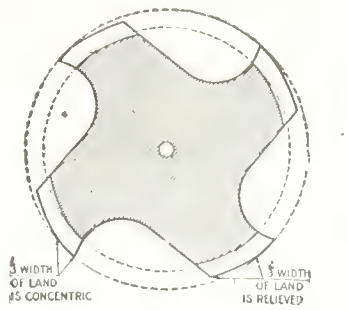
Special Features

The flute is fortified against severe twisting strains by a graduated depth which makes the "backbone" strongest where the strain is greatest.



When you buy a **Lightning** Tap you buy something beside metal.

Two-thirds the friction surface of ordinary taps is abolished by special eccentric relief, without weakening the support to the cutting edge. (See sketch).



ABILITY TO ORIGINATE — POWER TO PERPETUATE
A 3-FOLD ORGANIZATION OF TAP BUILDERS
THE SPIRIT OF PROGRESS

Sole Manufacturers

Wiley & Russell Mfg. Co., Division

Greenfield Tap and Die Corporation

Greenfield, Mass.

New York	Philadelphia	Chicago
28 Warren Street	38 North 6th Street	545 Washington Boulevard

ATTENTION !

Bridge Builders **Structural Steel Workers**

NOVO HIGH-SPEED STEEL Annealed

Are your Bull-Dies lasting continuous usage 8 days without re-cupping ? If not, try "NOVO."
No Hardening. No tempering. No re-annealing for re-cupping.

BRIDGE BUILDERS, REAMERS—Are yours averaging 30 to 40 hours continuous usage without regrinding? If not, try Novo—or send trial order for Novo Reamer. We carry all standard sizes in stock.

Your inquiries are respectfully solicited.

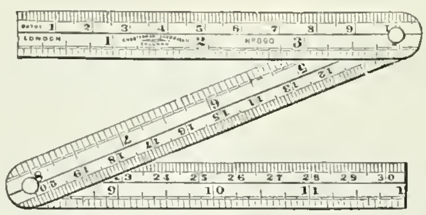
Hermann Boker & Co., - - - - - - - - - 332 St. James St., Montreal, P.Q.

JAMES CHESTERMAN & CO., Limited

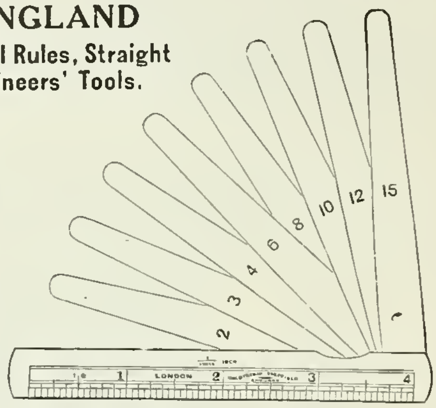
SHEFFIELD, ENGLAND

Manufacturers of Measuring Tapes, Steel Rules, Straight Edges, Surveyors' Band Chains, Engineers' Tools.

Wind-up Measures, Steel, Linen, and Metallic.
With Improved Patent Flush Handle.



Machine-Divided Pocket Steel Rule



Steel Feeler Gauge.

For Prices, Catalogs, etc., Apply to

F. H. SCOTT, 404 Coristine Bldg., MONTREAL

ARMSTRONG WHITWORTH OF CANADA

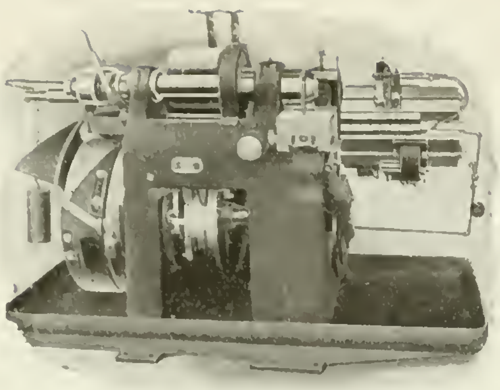
LIMITED

MANUFACTURERS OF CELEBRATED BRANDS OF

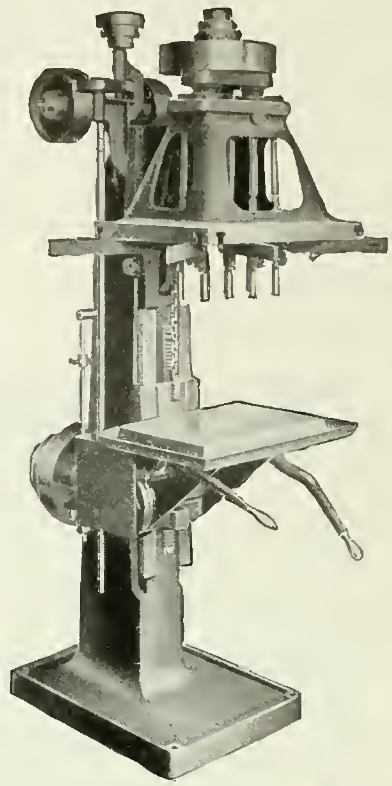
HIGH SPEED STEEL & DRILLS

"AW" FOR CUTTING ALL METALS AT HIGH SPEEDS — **FOR HARD METALS RAILWAY & TRAM TYRES "TYR"**

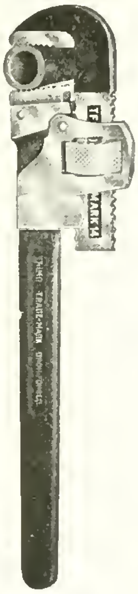
OFFICE 22 VICTORIA SQ. MONTREAL — WORKS LONGUEUIL QUE.



"GRIDLEY" SINGLE SPINDLE



Trimo Tools are World - Renowned



STEEL HANDLE

Trimo Pipe Wrenches are made in Steel Handles from 6-inch to 48-inch sizes inclusive. In Wood Handles they are made in sizes 6", 8", 10", 14" only.

NUT WITH NUT GUARDS

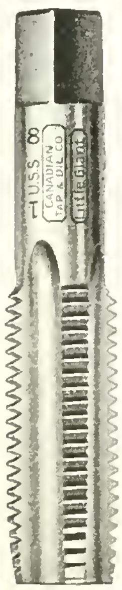
Send for Catalog No. 200

WOOD HANDLE

TRIMONT MANUFACTURING CO., Roxbury (Boston), Mass., U.S.A.

For the Toolmaker

Little Giant Taps and Dies



Are ideal, because

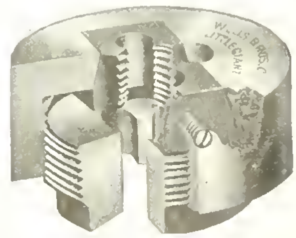
The taps have smoother thread walls than others.

The taps have the new type, reinforced "backbone"—extra strong.

The dies are gripped in their collets tighter than in a vise.

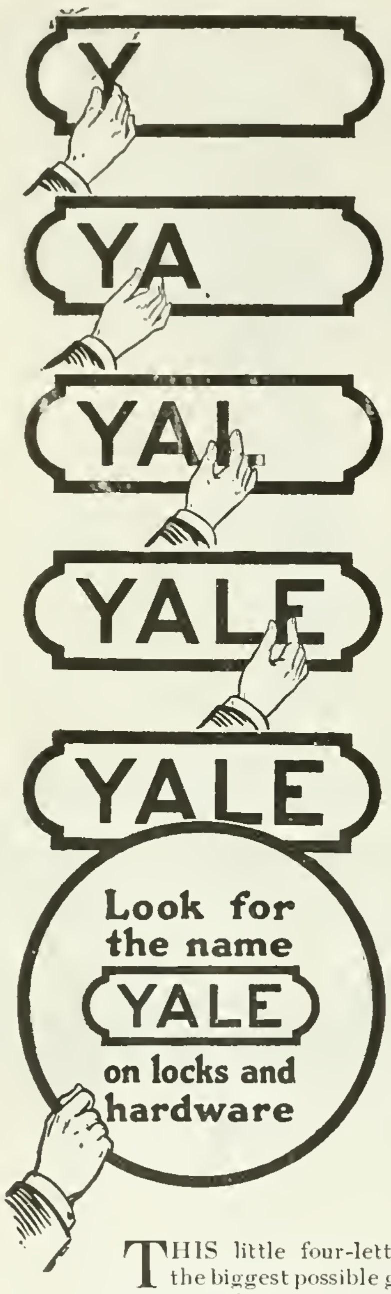
The dies can be adjusted far more accurately than "button" dies ever *can* be.

Made in a shop where the daily slogan is "*How Good*"—not "how cheap."



Wells Brothers Company
Division
Greenfield Tap and Die Corporation
Greenfield, Mass.

New York, 107 Lafayette St. Chicago, 13 So. Clinton St. Galt, Ont. London, 149 Queen Victoria St.



THIS little four-lettered word is the biggest possible guarantee you can have of quality, security and fitness in Locks, Padlocks, Night-latches, Door Closers, or Builders' Hardware.

Back of this guarantee stands an enviable record of successful achievement, built upon better goods, made in a better plant, and by better workmen.

Any good hardware dealer can show you Yale Products. Yale Locks and Hardware sold in Canada are now made in Canada.

Canadian Yale & Towne Limited

Makers of Yale Products

General Office and Works: St. Catharines, Ont.

NICHOLSON MADE

FILING AWAY YOUR PROFITS!

Each time your mechanic fails to use a NICHOLSON - MADE - FILE, he files away some of your profits.

Because with these famous files, he could do more work in less time, with less labor and at less cost.

For 50 years we've devoted every effort to producing the most efficient files that could be made.

Our facilities for controlling every process in our file-making, enable us to make **every** NICHOLSON - MADE - FILE **uniform** in quality.

Only in these files do you get the combined benefits of vast experience—splendid factory facilities—and a tremendous output that makes HIGH QUALITY compatible with LOW COST.

Our 50,000,000 production annually proves that NICHOLSON-MADE-FILES **do** cut down filing-costs.

Get the proof in your shops to-day. A trial is all that's asked—or needed.

BRANDS:

Kearney & Foot
Great Western
American
Arcade
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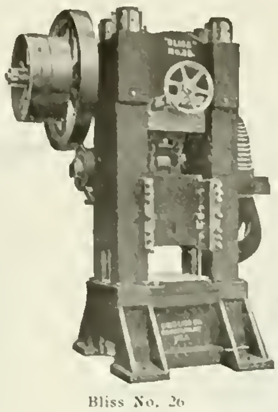

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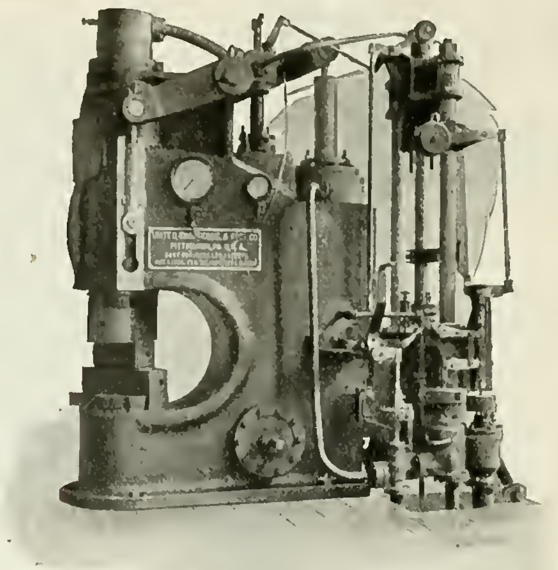

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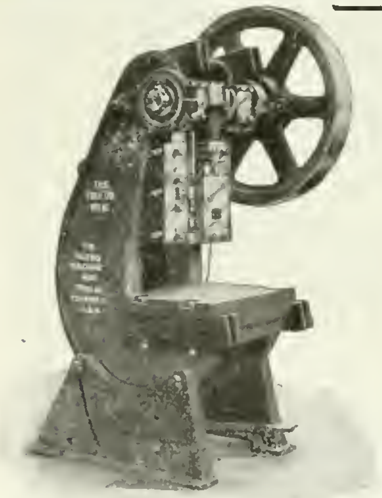

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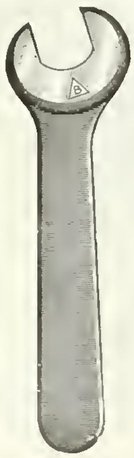

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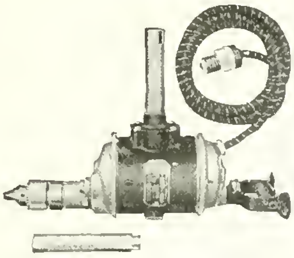

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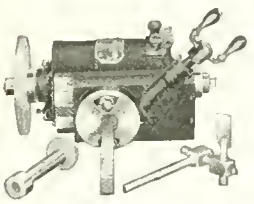

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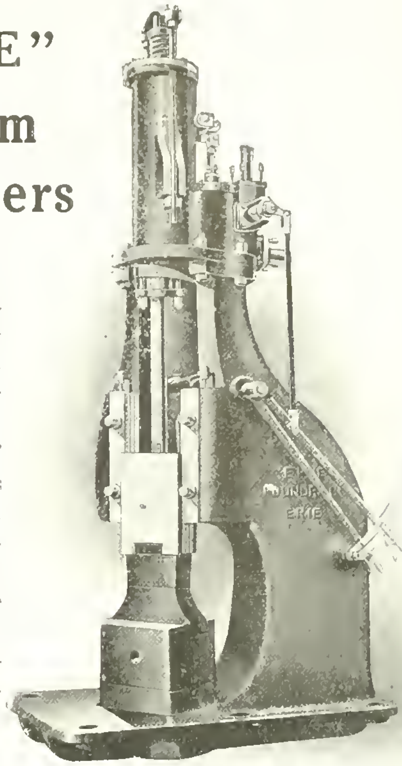

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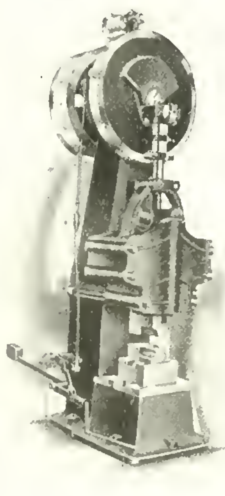

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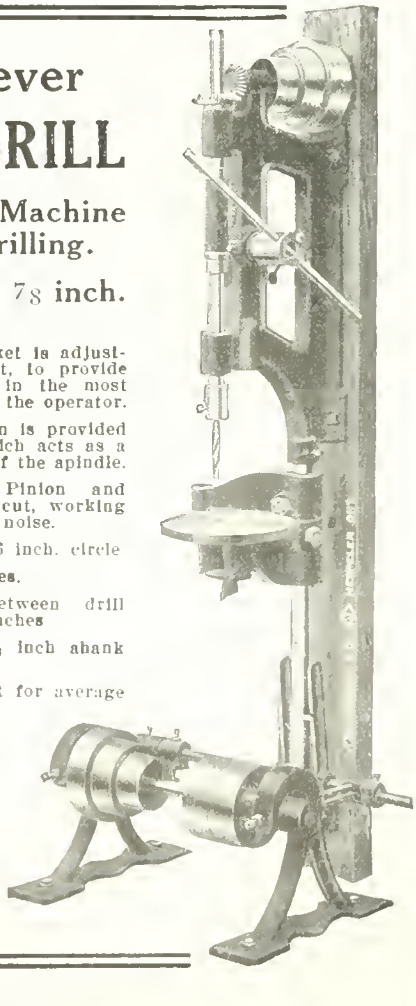

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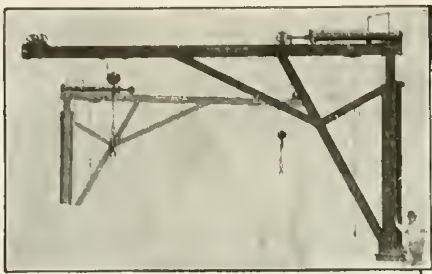

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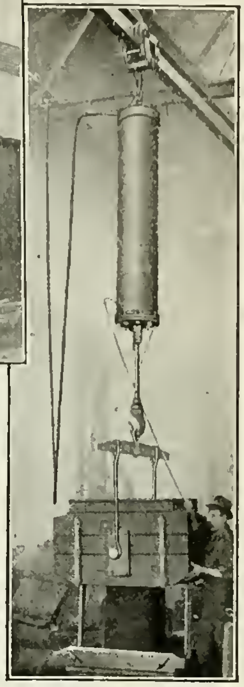

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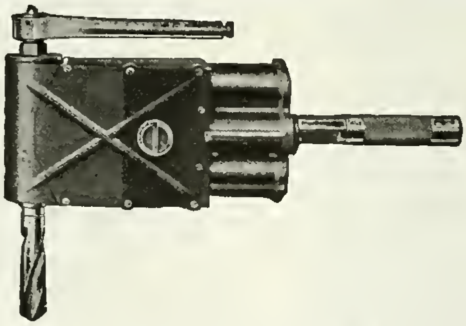

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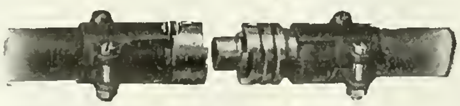

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Grinding Wheels in Interchangeable Manufacturing

By John Edgar

The present success in the methods of interchangeable manufacturing is largely the result of the grinding process. For instance, the automatic grinding of cylindrical parts is now taken for granted, whereas in a no distant past such was looked upon as a refinement, and called for only in precision work. Grinding of the general run of work is now a commercial necessity.

THE facility with which machine parts are sized is responsible for the general adoption of grinding, as also the fact that interchangeable manufacturing calls for the accurate sizing of parts within narrow limits. The grinding process has the additional quality of producing true work of uniform size throughout the whole length, which is not commonly the case in the results from the lathe. Its cheapness is also now readily acknowledged in comparison with that of the lathe, and, wherever tried, general adoption followed.

To get results, the wheel conditions, its feed and speed must be properly selected, and in order that these may be intelligently chosen, the different qualities of wheels in grade and grain must be familiar, then the proper wheel to use under particular conditions is only a matter of experience and judgment. The ordinary emery wheel is little used in the process of modern automatic grinding, emery having given way to the harder and better cutting abrasives, such as corundum, alundum, crystolom, carborundum, carborite, aloxite, adamite, etc.

Emery, the oldest of the abrasives in common use, is not a pure mineral, but contains a large percentage of iron, which has no abrasive quality. This makes emery a poor substance to use, as it becomes dull so quickly, and the wheel has a tendency to glaze when used on the harder grades of material. Corundum is also a natural abrasive and is largely used in automatic grinding, and in proper grades is a good substance for all-round work, being better adapted, however, to the grinding of hard and soft steels. The other abrasives mentioned are artificial, being the product of the electric furnace. They are much harder than the natural product of the mines, and being under constant control in the making, can be graded to any temper desired. Carborundum is the hardest substance known, coming next to the diamond.

Grading the Abrasive.

The abrasives are crushed and then run throuigh sieves, the mesh of which varies from coarse to fine. The fineness of the particles as let through the meshes are graded by the size of the holes in the screens and are given a grading number corresponding to the number of holes to the inch; thus, a mesh of 36 holes to the inch is used to grade 36-grain abrasive. The powdered abrasive is first screened through the finest sieve as 100, and what remains in the sieve is then screened through a coarser sieve, and so on until the coarsest grade has been screened. Thus we have the grain of the wheel corresponding to the size of the particles of abrasive used in its making. Wheels are often made up of different grains and are termed combination wheels.

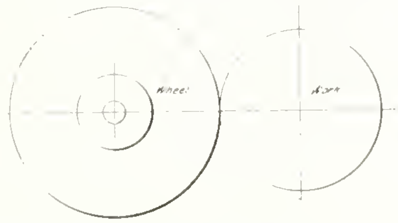


FIG. 1. SHOWING BROAD CONTACT ON LARGE WORK.

Forming the Wheel.

In forming the abrasive into a wheel it is necessary to use a bond to hold the particles of abrasive together. This bond is used as a cement and is usually composed of shellac, silicate of soda, or some sort of clay. Shellac is a strong bond and is used in the make-up of the so-called elastic wheels. The strength and elasticity of this bond make it safe for use in thin wheels. Shellac-bonded wheels are noted for their smooth cutting, and can be used for facing shoulders of considerable depth. Another form of elastic wheel is made with a bond of rubber or celluloid. These are not as free cutting wheels as the shellac-bonded and are used only in cases where an extra thin wheel is required.

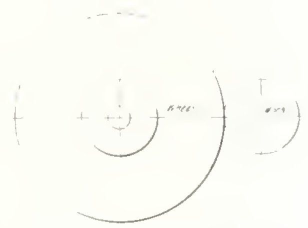


FIG. 2. SHOWING NARROW CONTACT ON SMALL WORK

Most wheels in use are bonded with clay and baked in a manner similar to the methods in the manufacture of brick, and are known as vitrified wheels. This process of wheel-making produces a very pure wheel and one unaffected by heat, cold, water, acids, oils, etc. They are porous in texture and the ease with which the grains are torn out when they become dull assures a free cutting wheel which will not clog up with particles of the materials on which it operates. This feature has its draw-backs, however, in the fact that the wheels are not so strong as those of the elastic bond and have practically no elasticity. Side cuts on thin vitrified wheels are dangerous. The process requires at least a month in the manufacture of the wheel, which is a decided disadvantage when a special wheel is desired.

The bond, silicate of soda, produces a wheel that has many of the advantages of the vitrified wheels, and the process of manufacture is more easily controlled, while a wheel can be produced in a much shorter time than that required to make the vitrified wheel, but silicate wheels of the finer grades are not as dependable as those of the vitrified process.

Wheel Grading.

Wheels are graded according to the strength of the bond, whether hard or soft. The wheels of weaker bond are the softer, while the hard wheels are those in which the particles are held strongly in place. The method of grading is the same with all manufacturers, although they have no uniform system as yet of designing the grade. The Norton Co. use the alphabet, running from soft to hard, while the carborundum wheels are graded just the opposite, the grades running from hard to soft. In the grading of elastic wheels, makers seem to recognize a more uniform grading as they all use the numerical system. The grading of the bond is not the only condition that determines the hardness of the wheel, as the grain of the material will have considerable influence on this, due to the finer grains forming a much more compact wheel. Therefore, a wheel of say 100E, will be harder than one of the same grade, but of 60 grain.

The success of the grinding process depends on the removal of the metal with little or no generation of heat, and to do this, the wheel must cut freely. This free cutting feature must be obtained with as little wheel wear as possible, or the work will not be true to size the whole length, this being more aggravated in the case of very long pieces.

Theory of Grinding Process.

The theory of the grinding process is that as the points of the grains of abrasive on the periphery of the wheel

are dulled they are torn out and new points present themselves to the work. If the points on becoming dull are not removed, the wheel must be forced into the work, generating heat, and glazing of the wheel results in the springing of the work and in chattering. The ideal condition is obtained when the wear of the wheel is uniform and constant.

To obtain this condition practice has shown that for hard material a soft wheel is preferred, and for grinding soft materials a hard wheel is the more suitable. This is accounted for by the fact that the grains of abrasive become dull more quickly in grinding the harder materials and must be removed faster, a condition accomplished in the softer wheels. In the grinding of the softer materials again, the grains do not dull so quickly and they may be retained in place for a longer time, therefore to use a soft wheel would be a waste of abrasive as the wear would not be in proper relation to the dulling of the points of the grains.

Wheel Grade, Width and Speed.

The grade of the wheel is also conditioned on the size or relative size of wheel and work; thus, when conditions are such that the contact of the wheel is of considerable extent as in the case of large work, the grade must be much softer than when the conditions are the opposite. Thus, in Fig. 1 the wheel should be much softer than that in Fig. 2, as the points of the abrasives are in contact with the work a longer time and become heated and dull much quicker than in the case of Fig. 2, and the sharp contact in the latter case tends to break away the particles of the wheel much quicker than when the contact is broader.

The width of the wheel has an important influence on production, and as wide a wheel as possible should be used. The wider the face, the more cutting points there are in action at one time, and consequently the feed can be greater. A wide wheel is better adapted for the removal of large quantities of stock.

The speed of the wheel is limited in most cases to a surface speed of approximately 5,000 feet per minute, but this may in the case of some of the harder wheels be increased to 7,000 feet, although it is best to keep the speed down to that recommended by the makers, as they are in the best position to determine the safe speed. The latter is always marked on the wheel together with the grade and grain, and these should be stated when ordering duplicates.

It is not necessary to use a fine grade wheel to obtain a good grade of finish, as the softer wheel of comparatively coarse grain will, when run under the proper condition of speed and feed, give a good commercial finish. Much greater production can be had with the coarse wheels, as they are freer cutting, and do not require dressing so often. The speed of the work is also important in the quality of the finish and the quantity of stock that can be removed. A too high speed of work will result in its being torn, in filling up the wheel and in chattering. The relative speed of wheel and work and the feed can only be ascertained by trial. The adjustment of one to agree with the other will result in the greatest possible production under the circumstances.

When a proper selection of wheel, its speed and feed has been made, the wheel must be kept in true condition to obtain good results. It must be trued with a diamond held in a fixed rest on the platen and run across the wheel face with an even motion. A wheel that is not true will result in a finish having a torn appearance, whereas with a true wheel the finish has a gray, dull appearance and will show the feed marks. As the wheel becomes slightly dulled, the finish takes more of a polished appearance and if suited to the work will remain in this desirable condition for a considerable time without redressing.

To the beginner in the use of the automatic grinder, there is no advice that can be given which will bring greater results than that he submit his problems to the manufacturers of the machine and obtain their advice on the wheel to use, together with the speed and feed best suited to the particular purpose. The wheel manufacturer can also give good advice in the selection of wheels. The manufacture of wheels is becoming so advanced that it is not necessary to have a wheel for each piece of work, but by adapting the conditions of speed and feed the same wheel will cover considerable ground.

While what has been said in the foregoing is given with particular reference to cylindrical grinding, the same can be said for surface work. This latter is becoming more common and the perfection of massive machines for the grinding of large plane surfaces is now in progress. Surface work is now successfully done with a disk or cup wheel, and is the process used in the grinding of washers and rings.

Form Grinding.

A new system coming into vogue is that of form grinding, in which the wheel is wide enough to cover the length of cut and is fed into the work instead of along parallel with its axis. This method has been successfully used in the grinding of crankshafts of automobiles, and its use has spread to other parts of short length, being particularly suitable to any short pieces that are stout enough to stand the pressure of the wide cut. This form grinding is also used in surface work where the width of surface is not excessive. At present a maximum of 6 in. is the practice.

Modern methods of wheel manufacture make it possible to perform this peculiar operation by providing a wheel that will wear evenly across the face and not develop ridges in the work. It has been found that the wheel will wear evenly to any shape it is given originally, provided the work is of the same shape; thus, for example, it is possible to grind to form the teeth of gears with a formed wheel passing through many teeth without reforming. It is necessary for this class of grinding to have a wheel that is not too hard as, if so, the wheel will glaze instead of wear to the shape.

While it is difficult to give a general rule in the proper selection of wheels for all classes of work, yet it is possible to select a few wheels that will be found suitable to most cases that may be termed ordinary work. The Brown & Sharpe Co. recommend as suitable for general work the following wheels:—

External Cylindrical Grinding.

On soft steel—Alundum 36-L combination. Corundum 2850-L.

On hardened steel—either of above; 46-K.

On cast iron or bronze—Crystolon, 50-L.

For facing shoulders—elastic Corundum, 80-1½; but for a less fine finish a 1¼ wheel of the same grain and material will give better production.

Surface Grinding.

On hardened steel—Corundum 46-H, or 60-¾ elastic.

On hardened high-speed steel or thin pieces of carbon steel, 36-M is recommended.

On cast iron—Carborundum 36-M.

Wheel Speed and Work Relation.

The relation between the speed of the wheel and the work is of importance and should be carefully studied. This may not be as easy of attainment as it might seem, and in view of the fact that the finish and rate of production is dependent on this relation it is well worth considerable time in experimenting with different speeds till a satisfactory combination is found. The surface speed of the work should be maintained at about the same rate for the same wheel and to do this, the rate of speed for the work must be reduced in proportion to its diameter as the latter increases. Thus, a 3-in. piece should revolve at only one-third the number of revolutions used in the case of a 1-in. piece.

If the wheel run at the correct speed and the work be too slow the finish will not be satisfactory and the wheel will have a tendency to become clogged up

with particles of metal and cause it to chatter. On the other hand, if the work be run too fast, the wheel will wear away too quickly, and produce a rough finish, or it may glaze and chatter. If the wheel is running too slow it will wear rapidly and the finish will not be fine. When the wheel runs too fast the work will become heated from the glazing of the wheel.

Most automatic grinding is now done with the aid of a stream of water to keep the work cool, otherwise care has to be exercised to avoid heating the work and thereby cause it to spring out of true. The latter is very noticeable on surface work when grinding thin pieces parallel. The water also washes the grit from the wheel and helps to keep it from glazing too quickly.

The Care of Brass Working Machines and Tools

By P. W. Blair

The life and use of factory equipment is shortened much more by the other uses to which it is subjected than to any amount of applying it to the work for which it was intended. A few pertinent suggestions on preventing the misuse of machines are therefore in order.

CONSIDERABLE expense and trouble have been caused to manufacturers through lack of mechanical knowledge on the part of unskilled labor employed in the production of brass and metal goods. Manufacturers in the metal industries are fast realizing the importance of employing mechanics of a higher order and educating their employees to a better understanding of the value of tools, their proper care, upkeep and the necessary conditions of operation to insure a desirable and satisfactory product. This has become quite necessary in order to compete successfully.

As an example, take many up-to-date plants that have installed expensive automatic machines and tools and entrusted the care of them to unskilled employees, who through carelessness or ignorance soon have the machines in poor condition or out of commission altogether. On the other hand, a good mechanic who has had proper training and instruction takes a natural pride in a good machine, does his utmost to keep it in good working order, and sees to it that it is not misused or abused.

Thoughtlessness of Operators.

In my visits to manufacturing plants I have seen many excellent examples of the care and operation of machine equipment and tools, and have also witnessed quite as many extremely bad examples. It is with the bad examples in particular and the possible remedies that I wish to deal in this article, and shall refer especially to the troubles experienced in the operation of tools for cutting, boring and screwing threads, as applied to the different styles of turret lathes and screw machines. In some plants I have seen screw machine operators use a hammer or heavy wrench for driving the turret tools out or into the holes of the turret. Possibly the shank of the tool was slightly large for the turret hole, or it may be that the operator had not sufficiently loosened the binding screw to permit easy entering of the tool shank. Lacking in horse sense and caring little for the tools anyway, he drives them out again until the tool has the appearance of having been used in the smith shop for a striking hammer.

Of course, this treatment very quickly springs the tool shank and puts the tool in so deplorable a condition that good work is impossible, and if it shows up with no marks the next time it is put in use, some one blames the manufacturers of the tool and reports that it is no good, and will not do satisfactory work.

Doubtless the man who writes the letters of complaint has no knowledge whatever of the true conditions, and his information comes from the machine operator through the foreman of the department or superintendent, and in many cases the machine operator is the only man who really knows where the real trouble lies. He is often too ignorant, it may be, to fully appreciate even the cause, for he has probably never been instructed not to use a hammer or anything with a hard surface in setting up tools in the turret. How then is he to get the tools into the turret holes if he does not use a hammer or anything that is handy to drive with? The tools were turned over to him to use on that machine, and if the shanks be slightly too large for the turret holes, or he does not happen to loosen up the clamping screws quite enough to give the shank access, his instinct tells him to take a hammer and drive it in or out. Besides, it does not cost him anything, so what difference does it make? The boss will buy another when this one is worn out.

When the superintendent investigates the cause of so much damage to tools and machines he is sometimes very much surprised, but he has so many things to attend to and look after that it is quite impossible for him to note all the details. The foreman on the job is generally taken to task for allowing these conditions to exist, but he as well is too busy to be able to give his personal attention or to see everything that happens. Something ultimately has, however, to be done to stop the waste. A system of examination of tools must be instituted when delivered from the tool storage to the operators at the different machines, or when received from them at the completion of each job, and any ill treatment of them carefully noted.

Features of Successful Operation.

The successful operation of any tool employed for the boring, facing and cutting of screw threads, and this is equally true of forming tools, depends on their proper grinding and sharpening. In many plants all tools are kept in a well-appointed tool-room, and there cared for by experienced mechanics, the machine operators not being allowed to grind or otherwise make changes. This work should all be done in the tool room, and under such conditions there is seldom cause for complaint. One of the best remedies I can recommend for the present abuse or tools is better factory organization, which places the proper care of all tools and machines in the hands of a competent person in a well-equipped tool storage room.

Employees' Instruction Book.

Another remedy I would suggest is a book of instructions, which should be issued to every man entering or already in the employ of the company, entitled "The Proper Care of Tools and Machines." I have seen this applied in a large brass manufacturing plant employing 900 men, and good results have accrued. A wise man will learn and will increase his learning, but fools despise wisdom and instruction. The contents of a book of instructions in an employee's hand at all times will eventually get to his mind, and there is less liability of his abusing tools or machines. This book could be made about 3 x 5 inches in size, and after the introduction and reasons for its existence, it should contain the following:

Before beginning work, a workman should carefully examine all tools when received by him from the tool-room, and report to his foreman if they are not in first class condition. If he fail to do this, such defective tools must be charged against him.

Oil your machine all over the first thing in the morning, as it works more satisfactorily.

Under no conditions use a file as a hammer, chisel or a pry.

Don't use a monkey wrench for the same purpose as a hammer.

A wrench used on the head of a bolt, or, in fact, anything that has a square,

must fit this square closely or it will gradually round off the corners.

When the chucks are put on the spindles of lathes or other machines, be sure that the threads on the spindles and in the chucks are cleaned of all chips and foreign matter, and oiled. Screw on the chuck by hand one-quarter turn of the spindle, and then give it one quick turn with the hand against the shoulder, which will tighten it sufficiently to keep it in place without causing trouble when it is taken off.

At least once a week the box-chucks should be oiled in their working parts, and when using collets see that all chips are out of the spindle of the lathe as well as the thread on collet before screwing it in.

When putting jaws into a chuck, both jaws and chuck must be free from chips. The chuck should be opened up wide enough to allow the hand to pass in under the false jaws. Next start the screw into the jaws and screw it up as far as possible with the fingers. After inserting both jaws in this way, screw up the chuck until the false jaws come together and press firmly into the tongue and groove.

This will release the chuck screw enough to allow you to tap on the face of the jaws with a piece of lead for the purpose of making them set even on the front face. Never use any hard material for this purpose, because it will mar the face of the jaws. After this is done, screw up the chuck screw until you have firmly grasped both jaws, then screw up both jaws tightly with a screwdriver.

All working parts of the tools should be kept well oiled. The shanks of the tools should be oiled and wiped lightly before inserting, so as to keep them from rusting if they are left in the machine for any length of time. All holes in the turret of a machine not occupied by tools should be kept plugged up with wooden plugs, so that chips will not enter and get into the working parts.

Gauges and templets of all kinds must be handled with care.

Never force a piece of work into a gauge.

Don't slip a ring gauge over a set screw on your machine, for the jolting or jarring of the machine will cause it to work on the set screw and eventually ruin it.

Threaded plug or female gauges should be screwed into a plug or socket to act as a protector for them when not in use and to avoid any damage to the threads. Never accept a taper shank drill from the tool-keeper when it has a broken or distorted tang. It may become loose and damage the socket.

When taking the chuck jaws out of a chuck, loosen the screws in the jaws, and, if they still hang tightly, insert a screwdriver into the chuck and pry open the jaws, which will loosen them.

Do not start a machine without knowing that everything is ready.

Do not do any unnecessary hammering on a drill-press table.

Always avoid doing any hammering on a machine if it can be possibly avoided. Do not hold a tool of any kind on an emery wheel until it gets blue.

Do not run a machine when any part of it is out of order without notifying your foreman.

Do not forget that a cutting off tool should have equal clearance on both sides, and do not blow filings or chips in among the running parts of a machine.

Tools should not be forced into a turret of a lathe, for the reason that it is very difficult to remove them after they have been so treated. Then, too, there is danger that the hole will be enlarged after frequent use, which would make it unfit to use with the regular tools.

Tools should fit in loosely, so that they can be inserted by hand. If the tools do not fit in this way, the foreman must be called, and he should see that they are made to fit properly. Always see that your tools line up on center when starting a new job.

If a tool becomes fast in the turret be sure that you do not injure it or the machine in trying to remove it. Try some of the following rules, and if your efforts do not meet with success call your foreman.

COMING CONVENTIONS.

Railway Supply Manufacturers' Association.—Atlantic City, June 10-17. J. D. Conway, secretary, 630 Oliver building, Pittsburgh.

American Society of Mechanical Engineers.—June 16-19, Minneapolis (headquarters at University of Minnesota). Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York.

American Institute of Chemical Engineers.—Troy, N.Y., June 17-20. J. C. Olsen, secretary, Brooklyn Polytechnic Institute, Brooklyn, N.Y.

Railway Master Mechanics.—Atlantic City, June 15-17. Joseph W. Taylor, secretary, Karpen building, Chicago.

American Society for Testing Materials.—Atlantic City, June 30-July 4 (headquarters Hotel Traymore). Prof. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Pa.

Railway Tool Foremen's Association. — Chicago. July 20-22. A. R. Davis, secretary-treasurer, 730 Pine street, Macon, Ga.

Railroad Master Blacksmiths. — Milwaukee, August 18-20. A. L. Woodward, secretary, C., H. & D. Railway, Lima, O.

American Foundrymen's Association. — Chicago, September 7-10 (headquarters Hotel LaSalle). A. O. Backert, secretary, Penton building, Cleveland.

Railway Bridge and Building Association. — Los Angeles, October 20-22. C. A. Lichty, secretary, C. & N. W. Railway, Chicago.

Bridge and Building Supply Men's Association.—Los Angeles, October 20-22. H. A. Nealy, secretary, Joseph Dixon Crucible Company, Boston.

Railway Electrical Manufacturers' Supply Association. — Chicago, October. J. Scribner, 1010 Monadnock building, Chicago.

Treatment of Miscellaneous Parts.

Centers.—If after loosening the set screw you are unable to remove the center by hand, take a block or bar of lead and tap it lightly. Do not rap or pound too hard, as you are liable to strain the center. If there be a flat on the center, you can use a monkey wrench to give it a turn. This applies to centers in monitor lathes only. Centers in spindles should be driven out with a rod put into the hollow of the spindle.

Tool-holders.—These should be treated the same as centers, except that you can generally get a monkey or stillson wrench around the holder to the set screw in order to give it a turn, or use it at the back so as to act as a wedge and force it straight out.

Tap Holders.—The last piece of every job should not be taken out of the chuck until you have tried to extract the tap holder from the turret. If too tight to remove by hand, the tap in the holder should be screwed into this piece of work. Next loosen the set screw holding the tap holder in the turret, run the carriage back and pull the tap holder out of the turret. This same rule applies to the adjusting of the tap holder in or out of the turret when adjusting it to work in connection with the templet.

Die Heads.—The above also applies to die heads. The last piece of a job should also be saved until you have determined that you can take out the die head by hand. If too tight for this purpose, run the die head onto the thread, hold the lever of the die head so that the chasers will not open up, then run the carriage back so that it is pulled out of the turret.

Chasers.—A bar of lead or a piece of wood should be used to tap lightly the chasers, so that they can be extracted from the die head if they are wedged in.

A wrench, hammer, or any hard material, such as brass, iron or steel, should never be used to adjust your tools in the turret, even to a fraction of an inch. Tap the tools lightly with a bar of lead whenever necessary. No hard material of any kind should lie on the bed of the lathe. The bed or shears should be covered with a smooth board. When putting a tool in the turret or holder, special care should be taken to turn the flat side of the shank, so that the set screw will set on it. If the set screw is screwed down on the round part of the shank it will spread it out and cause a lump to appear or even cause the shank to bend in the hole. The set screw should never be allowed to rest on the extreme end of the shank, for it will tip the tool out of center and allow it to creep from under the set screw and ruin the end. Always use square hard wood or lead block when taking off a box-chuck from the spindle.

Do not be contented with just knowing what shop kinks you have learned from this or somewhere else, but investigate and work out a few for yourself.

Keeping Down Investment in Raw Material Purchases

By E. W. Mackenzie *

This article shows how an up-to-date firm organized a department whose duty was to keep close watch on the stock, thereby enabling the purchasing agent to specialize entirely in the art of getting the most and the best on the market for the least money.

OF THE many questions with which managers of manufacturing concerns are battling during the present financial stringency, possibly no other is receiving more attention than the reduction of investment in raw materials without tying up one or more departments. If the factory has not the services of a department to look after that end of the business, this question becomes the nightmare of the shop foremen and the bugbear of the purchasing agent. The manager explains to his purchasing agent time after time the importance of reducing all purchases to a minimum, and on each occasion that the purchasing agent receives a requisition for material, he must know positively that there is nothing in the plant which can be utilized. This article is not written, however, to give in detail the troubles of a purchasing agent, and how he fights them out, but with a view of showing how one up-to-date firm took this responsibility from him and organized a department whose duty it became to keep a close watch on the stock and thereby give the purchasing agent the opportunity of specializing in the art of getting the most and the best on the market for the least money.

One of the contributory causes for the organization of a department to relieve the purchasing agent of this responsibility was due to the fact that previously material had been purchased and machined in such large quantities that storeroom space was sacrificed and large investments incurred on articles which were likely to be rendered obsolete because of new designs, or because stock was not kept in sufficient quantities to allow orders to be filled completely and efficiently. After all the various phases of the situation, both for and against, had been considered, it was finally decided that a department to regulate the amount of stock carried on hand and to see that material was ordered through the shop and placed in the warehouse ready to meet shipping orders, would more than pay for itself in the course of time.

Organizing Department.

The department organized was therefore termed the Stock Accounts Department, and was composed of what is commonly called a production foreman or engineer, together with the necessary number of clerks. The head of this department reported only to the works manager, and it might be well to say that his duties were to see that proper records were kept of every commodity in the plant; to keep a perpetual inventory of all material, whether purchased or manufactured; to see that orders were issued to each manufacturing department of the factory and to requisition on the purchasing department all purchased material.

Stock Inventory.

One of the first things to be secured was an inventory of all the stock and material, and after a careful inventory had been taken, including that which was in the raw state, in progress, machined and assembled, the stock ledgers were charged with same. A stores department was then organized for the purpose of keeping all raw and finished material in a specific place from which the stock could be disbursed as fast as orders were received. After these details were completed, instructions were issued to have all stock turned into the stores department, with the exception of that in the course of machining. As fast as this material was received into the stores, it was sorted out either according to size, number or symbol, and then placed in bins, which were labeled, numbered and indexed for ready reference, on cards supplied for the purpose, and these records were then transmitted to the office for the benefit of the stock accounts department.

It soon, however, became apparent, in order that the stock accounts department might order intelligently, that some official lists, including every item of material used in the assembly of a complete article, must be secured. The work of compiling these lists was handed over to the engineering department, they in turn supplying lists to the stock accounts, cost, stores and small assembly department, which set forth in detail all material required, and also the drawing and manufacturing symbols or numbers.

Whenever any changes in design or otherwise were made on the completed part covered by any list, these lists were recalled by the engineering department, the changes made thereon, and again returned to the various departments. It should also be added here that before any immediate changes in design were ordered which would make obsolete all stock on hand covered by a change, information was always secured from the stock accounts department as to the amount of stock on hand that would be affected by the change. This was followed out in order that a date could be set which would allow all stock being used which was on hand, and not necessitate its being scrapped or carried as repair stock in large quantities for any length of time and thereby have a large investment lying around.

In order that a proper check would be received in the stock accounts department of all stock and material delivered from the stores department, every employee was required to produce a written order signed by his foreman or by someone in authority, this order showing the number of pieces required, the weight, length or other unit of measurement, the size, symbol and description of the article required, the department desiring these supplies, and the bill of material or order number on which the stock was to apply. At the close of each day these orders or requisitions were turned into the stock accounts department, and all material appearing on same would be charged to the department to whom it was delivered and credited to the stores. After the stock accounts department had priced and entered up all the information in the ledgers, these requisitions were then to be turned over to the cost department for figuring and later on filed according to date for ready reference in case of dispute.

As a daily report of all the material and stock added and placed in the stores department was necessary in order that the stock ledgers might show from day to day the actual amount of stock on hand, the receiving department was required to forward a duplicate copy of their report to the stock accounts department. From this report the ledgers would be charged with all stock purchased, and this stock would then be applied against that on order. On manufactured articles a list similar in a great many respects would be forwarded from the stores department, showing the quantities, sizes, manufacturing numbers of symbols and the order on which they applied.

Anticipated Sales Provision.

To secure an official list of the articles to be manufactured for the purpose of ordering supplies and stock through the shop, an itemized list was secured

*Canadian Safety Engineering Bureau, Toronto.

from the sales department each week showing the shipping orders on hand and the amount of goods required, together with the time allowed on each order to produce the goods. Along with this, the sales department furnished a list showing their anticipated sales covering a period of twelve weeks. As all articles of manufacture were ordered through the shop in what may be considered units of manufacture, these units representing groups which could be placed on the erecting floor most conveniently and completed at the end of each week, the articles on the lists received from the sales department were accordingly grouped into units of manufacture. To each unit was assigned a number, and this number afterwards served for identifying the group. A list would then be made up by the stock accounts department showing the articles on shipping orders together with the unit number, while the position of the unit would show its relative importance on the list and attention accordingly given it in the shop and office. In cases where the stock already was in the warehouse covering an order, this would not then be shown.

Delivery Schedule.

As new orders were received from week to week and added to the schedule, it was continually changing, and the relative importance of each unit was accordingly changed. It became necessary, therefore, in the interest of economy and manufacturing conditions, to make the first three weeks fixed on the schedule—that is to say, whenever an article through the sales department's requirements had been placed within the bounds of the first three weeks, it could not be replaced by any other article of similar importance except in very urgent cases.

A copy of this schedule was placed in the hands of every department of the plant, and all work was ganged and put through with the end in view of having all stock machined and ready for assembling by the time any article was ordered assembled and with only such stock manufactured and carried as would cover twelve weeks.

In ordering material on the purchasing department, the stock accounts department would order only such material as would be necessary to cover the schedule. This material would then be requisitioned on forms which were numbered consecutively, and as the requisitions were passed over to the purchasing department for ordering, they would be entered on the ledgers. As fast as the purchasing department ordered the material, the duplicates of the orders would be forwarded to the stock accounts department and they in turn would apply them against the requisition number, thus showing that the requisition had received the purchasing department's attention and that the stock was ordered.

On ordering material machined through the shop, all departments who had work on a certain article would receive an order which was numbered in accordance with the set of numbers assigned to any one department, thereby assisting the cost department in posting labor to the orders for any one department. In every case, the cost department would receive a copy of the order for cost purposes. All labor being performed on the material covered by an order would be identified on the daily time cards according to the number of issue, and labor and expense items would be posted to the cost department's copy of the order, thereby making a complete cost record. These orders would show the date of issue, the symbol or part number, material made of, the sketch or drawing number on which the specifications for machining could be secured in the engineering department, the number of pieces required to the modification on which it was to apply, and the manufacturing unit number.

The stores department would also receive a copy of all the orders issued to the various manufacturing departments in order that they might have advance information of the quantity of stock passing through the shop, and to allow time for the preparation of storage room. The information contained on the order was always entered up on the stock ledgers, and the order then placed on the files in the department. The number of issue served a dual purpose for the stock accounts department, i.e., calling for an inventory of similar stock in the stores department and thereby overcoming discrepancies which might enter into the records, and, in addition, recording all orders issued for new stock.

Engineering Department Responsibility.

In a great many cases it was found convenient and economical to have the engineering department furnish subsidiary lists of small assemblies which went to make up an outfit or completed article. This was followed out in order to facilitate the handling of material in the stores department and with a view towards training the mechanics to become specialists along certain lines, by having certain employees assembling parts of standard articles constantly. Copies of these subsidiary lists were furnished to the small assembly and cost and stock accounts departments, and all orders issued to the small assembly department would call for a certain number of articles assembled according to the specifications shown on a specific list. Whenever the stores department delivered material to the small assembly department for assembling or fitting, the material was always disbursed according to that called for on the lists, and in this way a standard practice was thereby established and all responsibility was placed with the engineering department for the right material entering into the assemblies. After the material had been delivered, the stores department's copy of the order was forwarded to the office, and noted thereon were any shortages of stock. The stock accounts department would then credit the stores department with all the material disbursed, with the exceptions of that as shown short on the order. The shortages were then investigated and means taken for immediately overcoming them in order that the work might not be delayed in completion. On the final assemblies in the erecting department the same procedure was carried out.

The factory was enabled to work up stock as was required on each individual manufacturing unit through the use of unit shortages. Each unit shortage was made up in the stock accounts department, and revealed the number of parts that were short according to the ledgers on each manufacturing unit. It also bore the order or bill of material number and the department or departments who were holding these parts up. Copies of these shortages were then forwarded to each department concerned with a shortage, and a copy was also sent to the factory superintendent. These reports were checked up daily by a clerk whose duty it was to carry this out, and after they had been revised they were again returned to the various departments.

Results of Operation.

At inventory time, one year after this campaign to secure absolute control over all stock on the plant, the inventory figures revealed the fact that the value of stock carried was a good many thousands of dollars less than had been carried during previous years in comparison with the volume of business handled in similar periods. The efficiency of each department was increased by a large percentage due to expending energies along specific lines. Each foreman was kept constantly in touch with each department of the plant, and especially his own, with regard to the work required of him to meet shipments. The factory superintendent had records at hand constantly, and he was enabled through these shortages and through the general system of handling the work to increase or decrease the number of men required in each department, thereby keeping the distribution of work uniform and the efficiency of each department up to standard.

The system obviated the necessity of hunting up work for departments to keep the men busy or the overcrowding of other departments.

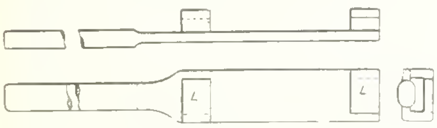
PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

USEFUL WRENCH EXTENSION.

By G. G. Jacion.

THE cut herewith shows a very useful tool in its place, so simple as to be very little used. It consists of a flat bar of machine steel with handle and



USEFUL WRENCH EXTENSION

lugs L L forged on. This extension with a litttle offset to accommodate double ended wrenches can be applied instantly to any kind of spanner to turn in either direction. It will be found very convenient to work the nuts down with the ordinary wrench and to apply the handle simply to tighten them up.

REPETITION MACHINES OF SPRING COVER PLATES.

"Werkstattstechnik."

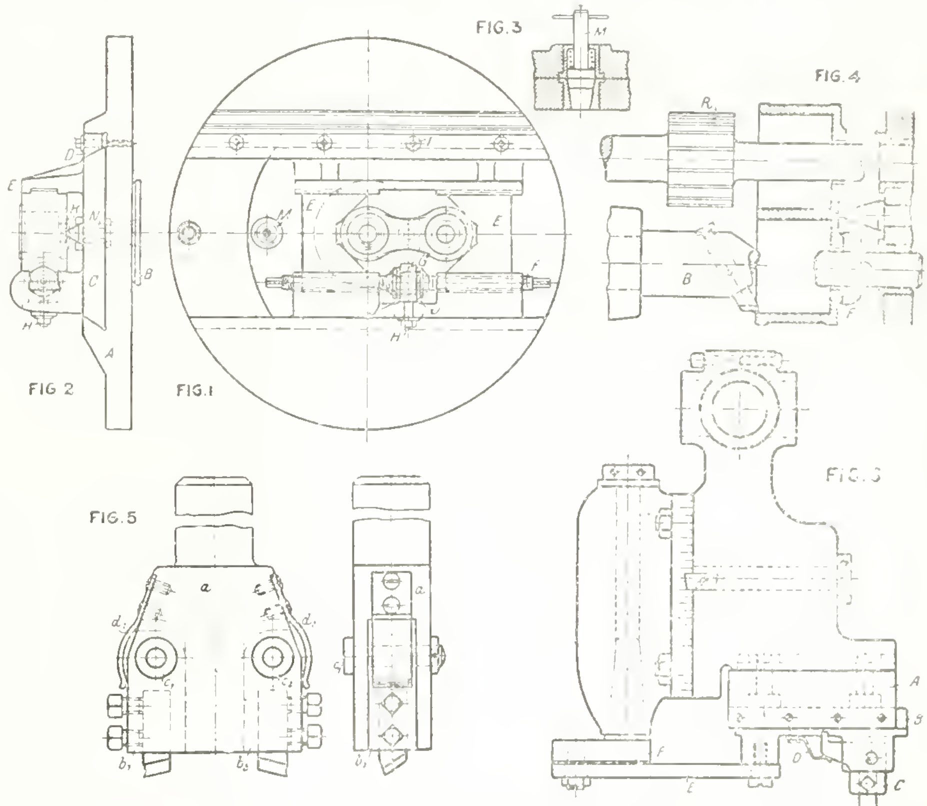
The device illustrated in Figs. 1—4 serves to hold pieces of various sizes which have to be bored and machined in a turret lathe. The cast iron plate A is centered by B in the chuck or the face of the lathe, and the slide C is adjusted and clamped by the bracket G and bolts I through the upper guide bar. The work is held by the jaws E E, the form of which secures the centering. Rigidity is ensured by the wide-set guides in CF for EE. The right and left threaded spindle F carried by G moves EE symmetrically together or apart. A divided bush finely threaded at each end is placed over a pin between two collars at the centre of F so that the latter can rotate, but not move axially. The bearing G is then put in place and fixed to C by H. Ring nuts J hold the divided bush firmly to the bearing bracket, but permit that axial adjustment of the bush and spindle required to center the jaws EE in the side.

The holes in the bottom of the piece are bored one after the other, the successive positions of the slide C being determined by the spring-pin M engaging in correctly placed hardened bushes in A. The slide is fixed during working by tightening the bolts I. The large bore of the shell is machined by a boring rod guided in the bush N (Figs. 2 and 4). The nave is machined by the same rod and the knife F; a longer tool being used to machine the front rim. The reamer R the spindle of which is guided by N, is used to complete the boring.

TOOL BOX FOR PLANING IN BOTH DIRECTIONS.

"Werkstattstechnik."

A double tool box construction permitting planing to be carried out in both directions, and thus eliminating the idle return stroke of an ordinary planing machine, is illustrated in Fig. 5. The tool holders b1, b2 are pivoted on spindles c1, c2 in the shell a and provided with rectangular holes for the reception of planing tools. The spring d1 or d2 and the resistance encountered by the tool when cutting sets the latter firmly against its seating on a. During its own return stroke (when the other tool is cutting), each tool is lifted against the spring d1 or d2 so as to clear the work. The shell a is forged in one piece with the stem which carries it. Cutting takes place during each stroke, and the tool box must be traversed after each stroke unless a second rather lighter cut it taken over the same line during the return stroke.



FIGS 1 TO 4. REPETITION MACHINES OF SPRING COVER PLATES
FIG 5. TOOL BOX FOR PLANING IN BOTH DIRECTIONS
FIG 6. SLOTTING ATTACHMENT FOR MILLING MACHINES

SLOTTING ATTACHMENT FOR MILLING MACHINES.

"Werkstattstechnik."

The slotting attachment illustrated in Fig. 6 is used with the vertical milling apparatus of an ordinary horizontal milling machine. The saddle A of the slotting attachment is bolted to the T-slotted surface of the vertical milling attachment. The piece B slides in A and carries the tool box C which is pivoted so that the tool may ride freely over the work during the return stroke. A spring D returns the tool box to its vertical position before the cutting stroke is commenced. Reciprocation of B is effected by a connecting rod E and crank F, the latter being carried by a conical shaft in the spindle bearing of the vertical milling device.

HINTS ON DRILLING.

By Arnley Leeds.

Few operations on shop tools are more frequently disappointing than the grinding and sharpening of drills. In shops where every operator grinds his own drills, more work is spoilt and drills broken than on any other machine tool.

There are very few shops that do not possess a drill sharpening machine, but if left to the drill operator to choose this or the grindstone,, he invariably chooses the latter.

The cutting edges of drills should have a proper and uniform angle with the longitudinal axis of the drill. They should be of exactly equal length, and the lips of the drill should be well backed off or cleared. If the clearance is insufficient or imperfect it will not cut. When force is applied it resists the power of the machine and is crushed or split.

Drills properly made have their cutting edges straight when ground to a proper angle, which is 59 degs. Grinding to a less angle is likely to produce a crooked and irregular hole. This angle is an index to the clearance. An effective method of determining the clearance is to set the point of the drill on a plain surface, holding a scale alongside. By revolving the drill, its clearance is shown, as well as the height of the cutting lips which should be equal.

When commencing work, run the drill for one or two holes at a slower feed and speed than those at which you intend to work. This enables the drill to warm up and is better than putting it immediately into heavy work. If the points of a drill become blunt or the cutting edges break away or chip, there is too much feed, and if the tendency is to wear away on the periphery, it is running too fast.

As the drill is shortened through use, the center shows thicker and will work harder in drilling. The reason for this is that a drill may be of sufficient strength to resist the torsional strain to which it is subjected in use, without being at the same time so thick at the point as to require excessive force to make it penetrate its work. The grooves being of increasing depth from the point to the shank, and the centre should be thinned to overcome this, care being taken to remove an equal amount of stock on each side, and to keep the point central. In grinding a drill the original form should be preserved.

ECONOMICAL WORKING OF MACHINE TOOLS.

By S. M. L.

Not long ago the manager of one of our large machine building concerns walked into the shop escorting a man who had a remarkable new high speed steel for sale. The foreman, after being duly introduced, prepared a powerful lathe to give the sample steel a tryout.

The test seemed to be a success; the manager was impressed; he admitted that he had never seen such a quantity of blue chips coming off in that lathe before, and left the shop in company with the demonstrator. The next day as the manager was making his rounds, the foreman quietly called him to the scene of the test of yesterday. The operative was making blue chips at the same rate as before, but with ordinary high speed steel. Seeing the manager interested, he replaced the tool with another of the same quality steel, increased the depth of cut and doubled the feed. The chips came off only slightly discolored and in lengths of convenient size to fall into the turnings box. The machine worked so quietly that it was difficult for the foreman to convince his superior that he was really doing more work with less power than before. The generosity of modern machines in furnishing power has caused the economical removing of metal to be somewhat lost sight of. The best steel is often that which is in the hands of the best man.

MANUFACTURING IN QUANTITY.

By A. E. S.

The ideal article for manufacturing purposes would be one that is favored with an unlimited market as far as the plant is concerned, and liable to no changes in design or construction from time to time. The absolute specialization of plant and machinery would thus permit of savings impossible by any other means.

Under these conditions, the machines operating on a single piece are divided into units or sets, the capacity of each element of which would be measured by the time necessary to perform the shortest operations. Thus, a set might consist of two machines for the first operation, four for the second, and one for the third in order to keep the work steadily progressing. If the capacity needs to be increased, it is usually accomplished by adding a complete unit. This permits true progressive or team production and as the different parts are to be used as fast as made, comparatively small storage capacity is required. The greatest engineering difficulty with this system is the keeping of every element working to its capacity and still maintaining a well balanced production.

The batch system which is the most used in Canada, can, by the exercise of care and capable management, be brought to a surprisingly high state of efficiency. It consists in the use of a semi-special class of machines so arranged as to be readily convertable for different operations. Storage and handling capacity is required for at least a complete batch of components, the larger the lots, of course, the better.

The dangers of this system are shortages and errors, and it is quite unlikely that an error once committed will be found out until assembling, when it will probably be discovered that a complete batch of parts has been spoiled. The essential, and so far, the only successful method of preventing these losses is the preparation of perfect individual and assembled samples. The man setting up the machine for the production of a certain piece should not only be provided with sample, gauges and templates, but his product should be periodically tried to the sample assembly. Care at this point of the manufacture not only facilitates assembling operations but will prevent the greatest loss arising from this system, that due to wrong sizes and shapes in large quantities of components.

Locomotive Boiler Tube Failures.—Writing on the subject of locomotive boiler tube failures, an engineer, whose work consists very largely of inspecting boilers of various kinds, raises the question as to whether it is advisable in the interests of safety to employ welded superheater tubes. To the men on locomotives, he says, the collapse or failure of one of these large tubes amounts to about the same as a crown plate failure, because in either case death or serious injury is almost certain. Therefore, if we are to have the same number of failures of superheater tubes due to welding that now occur with the smaller tubes, the injuries resulting therefrom will, owing to the increased size of the tubes, doubtless be so much more serious that, in the interests of safety, action will possibly have to be taken even to the extent of prohibiting welds in such large tubes. Many shops wherein tubes of this kind are manufactured and fitted are poorly equipped for handling the work. Adequate tests of welded tubes are in many instances not being made, and, as might be expected, there is a wide divergency of opinion as to the best method of doing such work. That the strength of a weld is practically an unknown quantity has been demonstrated times without number, and for this reason it is generally recognized in practice that where the highest degree of efficiency and reliability are required welds are prohibited.

Articles attacked by rust are said to be conveniently cleaned by dipping them in a well-saturated solution of stannic chloride, 12 to 24 hours sufficing according to the thickness of the rust. An excess of acid in the solution must be avoided. After the objects have been removed from the bath they must be rinsed with water, then with ammonia, and quickly dried. They are then said to resemble dead silver.

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MODERN MACHINE SHOP PRACTICE.

By H. Womersley.

IN modern workshop practice there are opening up slowly but surely large opportunities for procuring greater accuracy in machine and engine parts, and it is my purpose in this article to indicate directions from which we will be able to produce a better finished article at less cost than heretofore.

The aim of every engineer ought to be to obtain the best work in the shortest possible time, and at the lowest labor cost.

In a modern shop fine turning is no longer necessary or desirable; it is a waste of time.

Our industries are losing much because the foreman has to assume the intelligent guidance of workmen who, through prejudice, doubt, or fear, now rob us of the great economies due to modern methods. In many modern shops there is often a lack of co-operation between departments; but each succeeding period gives us more exact knowledge, while an ever-increasing amount of data is being obtained, which makes it easy to eradicate the weak spots.

Grinding.

To my mind no machine shop practice has made such an advance in recent years as has that of grinding. Undoubtedly, every up-to-date shop has its grinding machine. Modern requirements call for grinding. To-day the intelligent use of grinding wheels and machines is yielding large returns in many workshops, but there is still room for further study of this feature which will amply repay those who give it their consideration.

The grinding wheel as now made is a milling cutter with millions of cutting teeth, capable of cutting at a great speed. When mounted on a good machine it can be used at a cutting speed of 6,000 feet per minute. It is thus able to remove metal from certain forms of work more quickly than the milling cutter.

To mill different materials and obtain desired results the rate at which the machine is operated naturally has much to do with the quality and quantity of the work. For milling only three factors have to be taken into consideration—the depth of cut, surface speed of cutter, and the rate of feed of work. An additional factor, however, is brought into grinding that complicates the process somewhat. The work itself revolves and, of course, this has to be considered as well as the factors which correspond to those in milling.

Taking the milling machine again as an example, we know that wide ranges of speeds and feeds are required where there is a variety of work. Grinding is nothing more nor less than a milling operation upon a very fine scale, in place of the comparatively few points on a milling cutter, there being millions of points on the surface of a wheel. Hence it is evident that wide ranges of speeds and feeds are also essential in the grinding machine if the best results are to be obtained.

All users of grinding wheels recognize the great increase of efficiency in these tools during the past few years. Not many years ago, grinding was regarded as an expensive operation to be employed only where great accuracy was required, and as little stock as posible was left to be removed by the grinder. With the advent of more efficient wheels and mamachines it has been found economical to merely rough-turn the work in the lathe, and then pass it to the grinder to size and finish. Sometimes rough-turning is dispensed with, and the work is ground directly from the rough bar. It is hard to find records of the weight of stock removed by the old-fashioned emery wheel. In modern practice, wheels will often remove from two to three cubic inches of steel per minute.

Grinding Pointers.

When a wheel glazes it may be that the speed is too high, and when it wears rapidly the fault may be because it is running too slow. In such cases it is usual to correct the fault by changing the wheel. To secure the best results, the same surface speeds should be maintained as the wheel wears down. Complaints are often made that wheels get softer towards the middle, this being due to the slower surface speed, which causes the particles to wear away faster.

Wheels should be run towards the operator. Never crowd a wheel, as it will not cut any faster, but will simply heat the work, and wear itself out sooner. Never back a wheel, as it may be broken or so cracked as to break in use. Keep your wheels perfectly true and in balance, and dress them up a little each day.

For automatic grinding the harder the material to grind the softer should be the wheel; also the larger the surface of contact between the wheel and the work, the softer should be the wheel. A softer wheel is therefore needed for work of larger diameter than for small, and for surface grinding than for cylindrical grinding. The surface of contact is partly determined by the diameter of the wheel, so a small wheel should be harder than a large one for the same kind of work. Similarly a thin wheel should be harder than a thick one.

In cylindrical grinding, the finish depends upon the speed of the work, the speed and condition of the wheel, and, to a less extent the fineness of the wheel. A good commercial finish may be had with a wheel as coarse as No. 36, provided it is true, although misunderstanding exists as to just what constitutes good commercial grinding. Contrary to the common belief, work having a polished appearance is no more accurate than that having a dull appearance, and much valuable time is lost in obtaining it. For all commercial purposes, work finished to size and free from chatter marks is satisfactory unless for some special reason a polished surface is required.

Concluding, I would say that when the knowledge of grinding becomes more common, and the opposition to increased production on the part of workmen has been overcome, the field for grinding will be still more extended. The operator, by education and training, will help this field of grinding to a successful issue.

There are other fields of large promise in machine shop practice, but none excel that under discussion for it has become so extensive that it is difficult for one's brain to master the whole art. On every hand there is a demand for men who have digested the greatest amount of information in this direction. No attempt has been made to give the last word in this great subject; in fact little more than a surface scratch has been made, but it may be sufficient to establish a line of thought that will accomplish great things for those who allow it to possess them.

MODERN TRANSPORTATION—ELECTRIC TRUCKS.

As a contributor to technical publications in Paris, France, as well as automobile designer and builder since the work first started there, permit me to contradict Mr. D. Watson's conclusions in the following brief remarks, dictated by now 20 years' experience in automobile lines.

The princible advantage of automobile transportation is speed. If you can

go quicker than another, the other fellow is handicapped, and cannot succeed as well as you. Early birds get the worms. This alone would be enough to give the palm to gasoline trucks even if they need "the man born with a monkey wrench in his hand"! We grow that class of men in the old countries, and it is easy enough to get some seed. I have imported a lot, into Montreal, it thrives well, and has given many off-springs in a few years. Canadian soil is first class for the plantation. If Canada were to get behind the time, it would be a new era in Canadian affairs, I am sure. The main point in Mr. Watson's argument is not reasonable in Canada; smart "boys" being all over the country, willing and able to do the necessary job in a twinkling. The following points, however, Mr. Watson does not say a word about.

The Deadweight Feature.

Deadweight in electric trucks is about 2-3 of the total load, on account of the storage battery.

Deadweight in gasoline trucks is not over 1-3 of total load.

This means that to carry the same load in the same time (difference of speed not taken into consideration) three electric trucks are necessary to do the work of one gasoline truck. If speed be considered, in many cases, five electrics will be needed instead of one gasoline truck. Think then of the money invested, fixed charges, labor cost, and other items which would take too long for me to go into in this refutation, and judge for yourself.

Range of Delivery.

Range of delivery with electric trucks is very limited.

Range of delivery with gasoline trucks is unlimited.

This comes from the fact that storage batteries in electric trucks can but do the work their energy storage is calculated upon to do, and even in practice, it is well to reserve 20 per cent. under the calculation. If that "teamster" knows nothing about storage batteries, as Mr. Watson puts it, it is almost certain that the range of delivery of his electric truck will be curtailed by 30 per cent., and also that much damage will be caused to said battery ere said teamster gets home. Anyhow, a 45 to 50 miles range of delivery is a good average for the electric truck; it must be home then to lose time in reloading the storage battery; time which is money of course.

The gasoline truck starts in the morning with a load of goods thrice as heavy as the electric, and its range is unlimited, since the driver may buy gasoline anywhere on the road, and he gets home, having bothered no one at the stores in the daytime, having cleared the stores floor in the morning and made room for the sorting of more goods to be shipped away next morning. This is an advantage that made progressive Europeans settle the question of electric versus gasoline, by putting aside electric trucks altogether, some seven years ago. Why Canadians can be induced to make the experiment I fail to see, and it is to serve their interests, I am writing these lines so that they will judge for themselves.

The Tire Feature.

Roads are no better for electric trucks than for gasoline trucks. The wear and tear of tire is function of the mileage run, of the weight transported, and of the building of the car. Since to deliver the same weight, it takes electric trucks three units to one unit gasoline truck, from that sole standpoint the consumption of tires will appear three times as great in the expenditure of tires on the same mileage.

In practice, gasoline trucks seem to spend more tires than electric but this is due to the fact that comparison is made between one electric and one gasoline truck, irrespective of weight transported, and mileage run. In reality, on chosen roads, constantly on the flat, from experiments made in Paris, France, the expense of tires as between electric and gasoline trucks showed a ratio of 1 to 3, the latter being recorded against electric. The design of the truck (gasoline) counts also for much in the expenditure of tires. You see on the roads trucks with small wheels and others with large wheels. It would take too long to explain why differences in wheel sizes make a very big difference in the quality of motor cars and trucks in particular, but everybody will readily understand that running over one mile will necessitate fewer revolutions of large wheels than will be the case with small wheels. The rubber on large wheels will come less often in contact with the ground than in the case of small wheels, and the result will be that tires of large wheeled trucks will wear out less quickly than tires on small wheeled trucks. Such details are not taken into consideration in this country yet, but in time they will because it means much in the expense of tires.

Electric trucks are generally large wheeled, and maybe this is why expenditure in tires appears higher to Mr. Watson in gasoline trucks, those of American make, being mostly low wheeled, though the automobile building companies, whose make of touring cars are reproachless, also build reproachless trucks, their engineers being thoroughly imbued with real automobile principles.

Six or seven companies in the United States are producing cars and trucks in line with the highest scientific standards of Europe, but the majority of builders on the American side of the frontier, build not for a reputation, but for pure commercial purposes, with the result that they are led to wheeling their trucks low, because it costs money to wheel high, and they are in business for competition. The difference in mechanism for high wheeling is one-quarter of total cost of said mechanism, and to this comes in addition, one-third more rubber on each wheel, that is to say close upon $150 for that item alone. Customers, or I should say users of trucks do not take that in consideration when purchasing a truck, but they pay for it dearly in the running of it. Mr. Watson is probably comparing high wheeled electric, with low wheeled gasoline trucks, but even there, the difference is in favor of gasoline driven trucks.

Repairs and Depreciation.

Repairs to electric compared with gasoline trucks should not prove higher on one side than on the other, if first-class gasoline trucks are used, because builders of the first class gasoline machines use everything of the highest and best quality, and it is seldom any important part proves defective, while they are all made to last many years.

What about the short circuit in electric storage batteries? Does this happen or not? When a short circuit is formed in a battery, is it not the end of it as a rule, and what of its cost? I will not say that it happens with all electric storage batteries, but 50 per cent. of them are one day or another victims of that particular trouble.

In well organized transportation concerns, there is no more repair work required on the electric than on the gasoline truck, because attention and care is at the root of the organization, but for a firm having a couple or so of trucks, no particular organization can be got either for the one or the other, and there are great odds against the electric which do not exist against the gasoline truck, so far as repairs and depreciation are concerned.

Equal to the Occasion. — Peals of laughter came from the president's room as the secretary stepped out. "Mr. Green is too busy to see you at present," said the secretary politely. "I'm sorry," said the man who had called on business. "Will you go back and tell Mr. Green that I've got two stories just as good as the one he's heard, if he'll let me in to tell them?"

Series of Practical Questions and Answers for Mechanics

Every care is being taken to include only pertinent practical questions, and give same direct, reliable answers. Catch questions will be avoided. Attention is drawn to the alternating course in arithmetic, a concurrent study of which is recommended with that of the Question and Answer Series.

RELATING TO STRENGTH OF MATERIALS.

THE most common formula in strength of materials is that used in connection with beams of all kinds and is $\frac{M}{S} = \frac{I}{C}$. This is an extremely easy one to remember, and will well repay any mechanic or draftsman's effort. The manipulation of formulae is important, and is really the aim of the study of algebra. However, by a very little application and practice with simple examples, anyone can handle the formulae met with in the average technical reading.

The above formula, and any other for that matter, is merely a statement of the relation that the different factors involved in a calculation bear to each other. Thus, should we desire to find M, the other three quantities being known, the formula $\frac{M}{S} = \frac{I}{C}$ would become $M = \frac{I}{C} \times S$, and likewise $I = \frac{M}{S} \times C$; a strong similarity. $S = \frac{c}{I} \times M$, and $c = \frac{S}{M} \times I$, another striking similarity. Notice the difference in dealing with multipliers and dividers, those above the line and those below.

* * *

Question.—A 75-ton hydraulic press is supported by four 2-inch round steel bars. What is the unit stress in the bars when the machine is working to capacity?

Answer.—Area of cross-section of a 2-inch round bar is $2^2 \times .7854 = 3.1416$ sq. in. Total area of four bars is $3.1416 \times 4 = 12.5664$ sq. ins. Total load distributed over this area is $75 \times 2{,}000 = 150{,}000$ lbs., or stress per sq. in. in bars $\frac{150{,}000}{12.5664} = 11936.6$ lbs.

* * *

Question.—It is found, by means of vector diagrams, that the load on a tension member of a bridge truss is 107,000 lbs. This member must be made up of three bars 1 inch thick. Considering the ultimate strength of steel to be 60,000 lbs. per sq. in. and adopting a factor of safety of 5, how wide should these bars be?

Answer.—Total load is 107,000 lbs. Allowable working stress is $\frac{60{,}000}{5} = 12{,}000$ lbs. sq. in. Cross sectional area of steel necessary is $\frac{107{,}000}{12{,}000} = 8.916$ sq. in. The width of bars necessary then would be $\frac{8.916}{3 \times 1} = 2.967$ inches, or say 3 in.

* * *

Question.—A steel sounding wire 3/8 in. in diameter has a tensile strength of 110,000 lbs. per sq. in. What weight would it support a mile below the surface of the sea?

Answer—The area of the cross-section of the wire is $.375^2 \times .7854 = .1104$ sq. in. This would support a load of $110{,}000 \times .1104 = 12{,}144$ lbs. One mile of wire at the rate of .376 lb. per foot weighs $.376 \times 5280 = 1985.3$ lbs. The volume of water displaced by the wire would be $\frac{.1104 \times 12 \times 5280}{1728} = 4.05$ cu. ft. Its weight is $4.05 \times 62.5 = 253.1$ lbs. The weight of the immersed wire then is $1985.3 - 253.1 = 1732.2$ lbs., and the weight that could be attached to this without breaking it would be $12{,}144 - 1732 = 10{,}412$ lbs.

* * *

Question.—If the allowable working stress in piston rods is 8,000 lbs. per sq. in., what should be the size of the rod for a 24-inch piston with a maximum steam pressure of 120 lbs. per sq. in.?

Answer.—Area of piston $= 24 \times 24 \times .7854 = 452.389$ sq. in. Total possible load is $452.389 \times 120 = 54286.68$ lbs. Number of sq. ins. required is $\frac{54286.68}{8000} = 6.785$ sq. in. This would be furnished by a shaft $= \sqrt{\frac{6.785}{.7854}} = 2.94$ in dia., or say a 3-inch shaft.

* * *

Question.—The maximum thrust on a piston rod of an engine is 62,000 pounds. If the working strength of steel subjected to shearing under these conditions is 6,000 lb. per sq. in., what size crank pin would be required?

Answer—Shearing strength depends upon the cross sectional area to be sheared off in case of failure. Amount of material necessary is $\frac{62{,}000}{6{,}000} = 10.33$ sq. in. The diameter of a pin necessary to give 10.333 sq. inches would be $\sqrt{\frac{10.333}{.7854}} = 3.62$ in., say 3 5/8 inches.

* * *

Question—Skill in design consists largely in making all the parts of a mechanism equally strong. How thick should the head of a 2-inch bolt be in order that the resistance to stripping the head off be equal to the tensile strength of the bolt?

Answer—For a steel bolt consider tensile strength equal to 60,000 lbs. per sq. in. and shearing strength to be 48,000 lbs. per sq. in. The total tensile load a 2-inch bolt would stand $= 2^2 \times .7854 \times 60{,}000 = 188{,}496$ lbs. The shearing strength of the head must equal this. The necessary shearing area will be $\frac{188{,}496}{48{,}000} = 3.927$ sq. in. One dimension of this area is the circumference of the bolt, which is $2 \times 3.1416 = 6.2832$ in. Necessary thickness of bolt head then is $3.927 \div 6.2832 = .624$ in.

* * *

Question—A piston rod is subjected to a pull of 30,000 lbs. What should be the dimensions of a cross-head key one inch thick?

Answer—This key would be in double shear, therefore the length of the shearing surface would be 2 inches. Using a working stress of 6,000 lbs. per sq. in., a shearing area of $\frac{30{,}000}{6{,}000} = 5$ sq. in. would be required. The depth of the required key, then, would be $\frac{5}{2} = 2.5$ inches.

* * *

Question—The cast iron cylinder of a hydraulic press is 10-inch bore and is subjected to a pressure of 5,000 lbs. per sq. in. How thick should the metal be?

Answer—Consider a section of the length 1 inch long. The pressure tending to separate it into two halves is $1 \times 10 \times 5000 = 50{,}000$ pounds, which is 25,000 lbs. on each side. Working strength of cast iron under these conditions is 3,000 lbs. per sq. in. As a section 1 inch long is subjected to 25,000 lbs., the necessary thickness would be $\frac{25{,}000}{3{,}000} = 8.33$ inches.

Green Sand Molds and Their Place in Foundry Practice

By H. R. Shackleton

The subject matter of this article is from a prize essay submitted to the Keighley Association of Engineers. While covering ground familiar to many, it contains much that is of interest and value to those who are novices in the art of iron founding.

As is well known, those molds that are made in various kinds of sands and retain their own moisture till poured or cast, are termed green-sand molds. This method is, without doubt, the one for making the majority of castings in ordinary foundries doing work in connection with modern engineering.

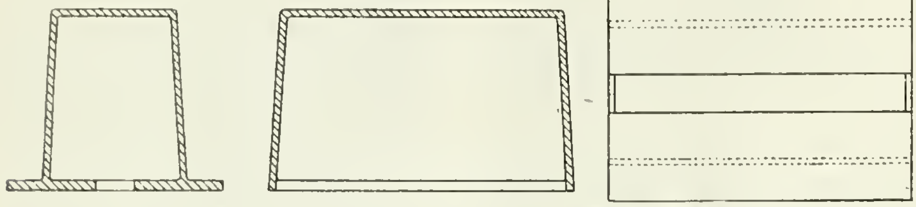


FIG. 1.—SECTIONS AND INVERTED PLAN OF A STEAM CHEST CASTING.

Skin-dried Molds.

Skin-dried molds are those which are rammed up in green-sand, and are then dried skin-deep, after being cleaned up and washed with wet blacking. It will be seen that by skin-drying a mold, the moisture on the surface or face of the mold is reduced to some extent. Skin-dried molds often give sounder and much cleaner castings than do green-sand molds, and when cast do not generate as much steam and gas, and are therefore less liable to give blown or scabbed and dirty castings.

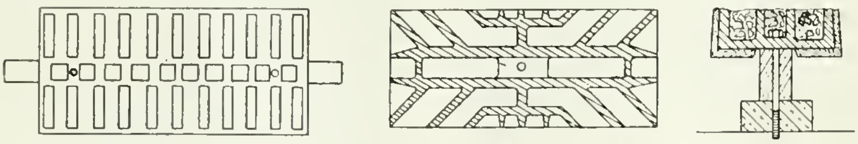


FIG. 2.—INVERTED PLAN, SECTIONAL PLAN AND CROSS SECTION OF CORE IRON.

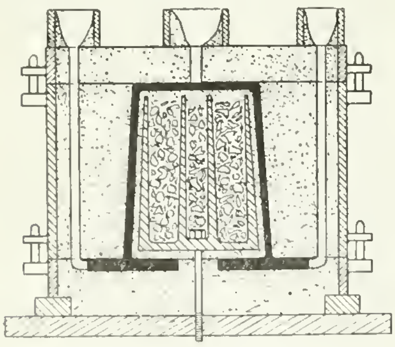


FIG. 3.—SECTION OF ASSEMBLED MOLD FOR CASTING, FIG. 1.

There are molds which it is absolutely necessary to skin-dry, owing to their intricate and delicate construction, such molds being better able to withstand the flow and force of the molten metal in passing down the runner and then over the face of the mold at the time of casting. Reducing the moisture on the face and walls of a mold also stiffens the green-sand cores, and there is not the same likelihood of particles being washed up from the face and the walls of the mold as with green-sand molds.

Dry-sand Molds.

Dry-sand molds are those which are rammed up in the same way as the ordinary green-sand mold, very little regard being given to the amount of moisture the sand contains, so long as the mold will retain its true form and shape. These molds should be vented to a certain extent in precisely the same way as green-sand molds, for although there is no moisture to evict or force through the walls of the mold, there is always a certain amount of gas generated in the sand at the time of casting, which will pass and escape through the vents, without any marked effect.

When not vented, sometimes these molds explode or ignite their gases before the pouring or casting is finished, and the shock causes the face or top of the mold to suffer by small pieces being shaken off, the result being a dirty and unsatisfactory casting, only fit perhaps for the scrap-heap.

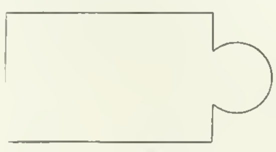


FIG. 4.—WEIGHING MACHINE BASE.

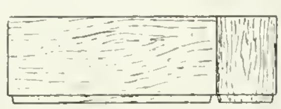


FIG. 5.—SIDE VIEW OF PATTERN.

Loam Molds

Loam molds are swept up by strickles or striking boards, which revolve around brickwork built roughly to the shape of the intended mold; plastic loam is applied to the brickwork, and is struck on or off, as the case may be, by the striking board or strickle, which revolves on a fixed centre for cylindrical work. The porosity and cohesive properties of loam are obtained by grinding strong sand with water and adding horse manure to give porosity and also claywash and hair for cohesion, or bond. The material is ground to the required state of strength and porosity, and the molds are blackwashed and dried before casting.

Molding in Green Sand.

When molding in green sand, those sands that are charged with moisture above a certain limit should not be used, as any attempt to pour hot metal into a wet mold will immediately generate dangerously large quantities of steam and gas, and the molten metal will not lie on the bottom or face of the mold, gases and steam causing it to be blown or forced back through the runners and risers just after casting. A mold of this kind is no good whatever, but serves to show the danger of an excess of moisture in green sand used for molding. No extra amount of venting will insure a sound casting in such circumstances, and even did the casting appear to be a success, there will be trouble with machining and fitting, and the castings will not stand the strain sometimes required of them, being too hard and brittle.

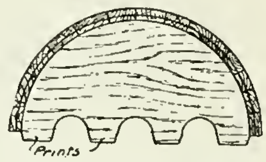


FIG. 7.—SIDE SECTION OF SOLID PATTERN FOR GEAR CASE.

On the other hand, sand rather too dry will not bind, but will fall and crumble away: or if it did stand in the mold, it will very likely be washed away from its position by the force of metal passing from the runner into the mold. It is evident, then, that sound judgment and

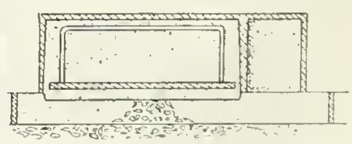


FIG. 6.—METHOD OF MOULDING.

experience combined are required to determine the amount of moisture to be used in the making of clean green-sand molds, which will readily discharge the

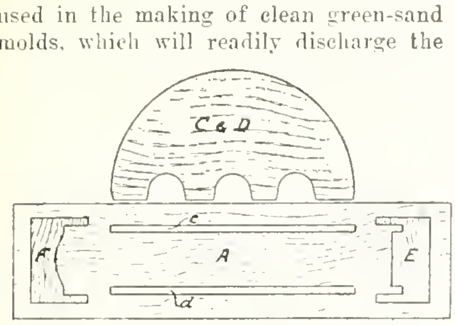


FIG. 8.—CORE BOARD AND FITTINGS FOR MOLDING GEAR CASE.

air and gases, and cause no trouble for the molder or anyone concerned.

Facing sands for green-sand molds call for a large amount of study for various

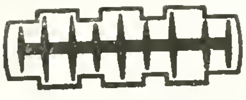


FIG. 9.—CORE IRON FOR GEAR CASE.

classes of work. Strong or new sands, when ground in the sand mill, increase in bond, and if they are ground too long are entirely unfit for facing sand, so it

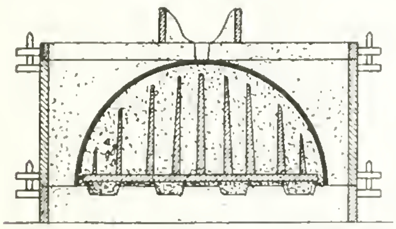


FIG. 10.—SECTION OF COMPLETE MOLD FOR GEAR CASE.

will be seen that a weak sand may be made strong, and a strong sand may be made stronger, up to a certain point, providing there is the necessary amount of moisture present. Sands that contain no clay or bond, or what may be termed sharp or washed sands, are those which must be used to give the required porosity. The sand must retain its shape or form in the mold, so as to give a good face on the casting, and also be so porous that the air and gas may be driven out of the mold without any obstruction, at the time of casting, thereby allowing

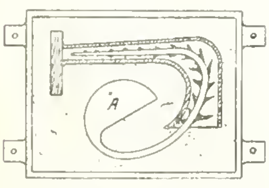


FIG. 11.—MOLDING A SEWING MACHINE ARM

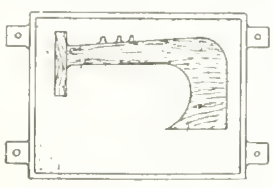


FIG. 12.—PATTERN IN MOLD.

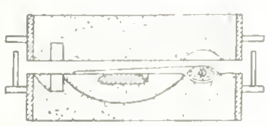


FIG. 13. SECTION THROUGH MOLD.

the metal to lie at rest. Some castings require to have a very fine and smooth surface, these being, as a rule, light and of various descriptions.

Yellow sands are more even in their bond and porosity and are mixed in varying strengths, to suit nearly all classes

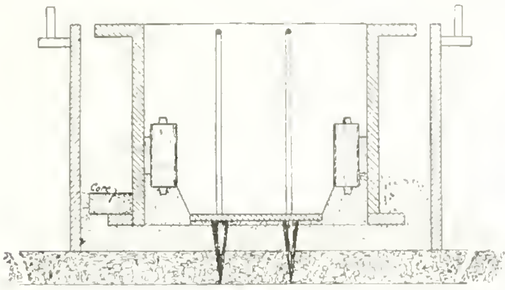


FIG. 14.—MOLDING A MOLDING MACHINE BODY.

of foundry work. All foundry sands are affected by atmospheric changes; in other words, an intricate casting may be made to-day with ease and to-morrow

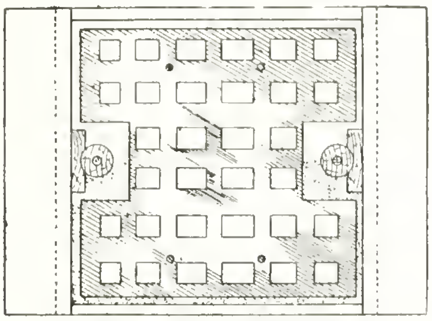


FIG. 17.—CORE PLATE.

may be quite difficult. Also, the finer or closer the sand and the higher the percentage of clay, the greater the risk of

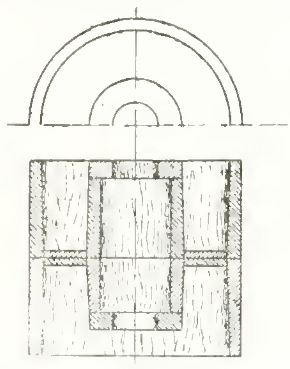


FIG. 18.—PULLEY PATTERN.

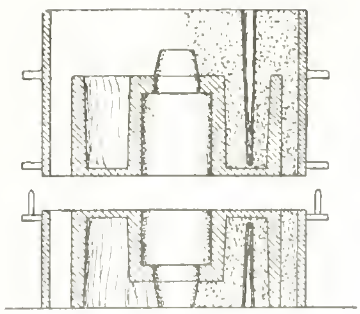


FIG. 19.—METHOD OF MOLDING PULLEY.

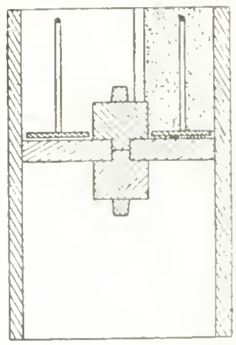


FIG. 20.—MOLDING WEB PULLEY WITH LOOSE WEB.

the casting being blown or scabbed, and also the greater the time required in venting the mold compared with an open or porous sand.

The accompanying sketches describe the making of some green-sand molds. Fig. 1 shows sections and inverted plan of a pattern of a type of steam-chest. The core for this casting requires some

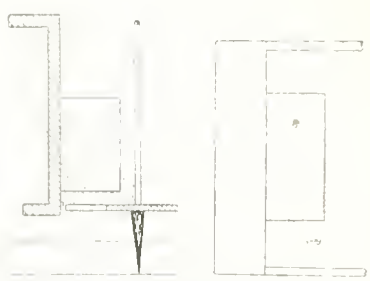


FIG. 15.—SHOWING METHOD OF PLACING BOSS. FIG. 16.—PLAN OF CORE PRINT FOR BOSS.

provision to be made for holding it together in the mold, and also to keep it from being lifted or moved while the metal is being poured. Fig. 2 shows the core iron, bottom side, with two lugs which rest on a couple of bricks before being bolted down to the bottom bar shown in Fig. 3. This is simply a flat plate with a screw-hole in the centre, which takes a screw-bolt and holds the core from rising. The core iron is prodded almost to the depth of the inside core, as shown in Fig. 3, and these prods help to stay or hold the inside core together, and also the small coke or breeze which is placed in the middle of the core to assist in making the green-sand core as light as possible.

This mold is entirely built on a coke or cinder bed, so that every facility is given for the core to discharge its gases. The secret of making this class of casting is in the use of a clean, open or porous sand. On the first occasion on which the writer saw this casting made the core was not bolted down, but chaplets were placed on the core instead, and when they were bored and plugged the casting showed a certain amount of porosity, and was, therefore, rejected.

In Figs. 4, 5 and 6 is shown a base for a platform weighing-machine, with the inside core made in green sand and lifted direct from the core box into the core-print in the mold. The round section is made in dry sand, as it is much smaller to dry in the core oven.

In Fig. 7 is shown a side section of a solid pattern of a gear case, which does not require any particulars as regards molding. In Fig. 8 is shown the core-board A, and on this board, at ? and d, fit boards C and D. The clamp E holds the two sides straight up. The sweep or strickle is shown at F. The core iron is seen in Fig. 9, while Fig. 10 is a section of the complete mold of the gear case, ready for casting.

It may be mentioned that the base for the platform weighing-machine, and also the gear case, are only molded this way till standard patterns are available, which leave their own cores in green sand when the pattern is withdrawn from the mold.

In Fig. 11 is shown a sewing-machine hollow arm which is molded in an ordinary two-part box. This arm is entirely hollow, and the green-sand core is made at the time the pattern is rammed up, the pattern leaving its own core. This core is entirely carried on the core iron A. As this core has no bearing, except at one end, to keep it from rising and falling, a weight is cast on the core iron, which is bedded or rammed in the drag part of the box, and is thereby kept

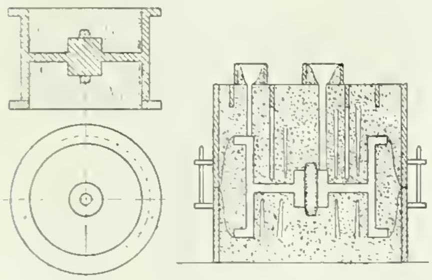


FIG. 21.

stationary till cast. This mold is made with two sand joints, termed a rolling joint.

Figs. 14 to 17 illustrate the molding of a molding-machine body. Owing to the construction of this pattern not being entirely satisfactory, the method shown was adopted. All the inside is lifted out on the core plate as shown. The core plate is lifted out and then the pattern is withdrawn from the mold. Next the portion of sand under the boss pattern at the right-hand side of Fig. 14 has to be cut away before the bottom flanges can be withdrawn, which causes a lot of time to be wasted. The writer would rather withdraw the flanges when ramming up, and cover with a dry-sand core, as shown at the left-hand side, Fig. 14. This method makes a better casting. In Fig. 15 will be seen a half-section of the same casting, the boss being made or put together by two cores made in a core-box.

Fig. 16 is a plan showing core-print of the same method, while in Fig. 15 it will be noted that all the inside is lifted out on the core plate. Fig. 17 shows a plan of the core-plate.

Fig. 18 depicts a half-section of a pulley and shows how the patterns are made in wood, while in Fig. 19 is a sketch of the two halves of the pulley in their respective positions in the cope and drag parts of a molding box, which method is preferable where time is of any consideration. It is also far better to withdraw a pattern from the mold than to withdraw a top part of a mold from a straight and sometimes rough pattern. In Fig. 20 is shown a system of molding a web pulley, where the web is loose, and also the bosses, which are set by a gauge to the depth of pulley required.

Assuming that the pattern is rammed up as shown, the outside rim is withdrawn first, the cope is put on, and the core-iron staples scotched up, bringing the inside core and also half of the boss which is loose. The bosses are withdrawn, the mold is then cleaned up and finished and closed ready for casting.

In Fig. 21 is shown a flanged pulley, and also the finished mold, which is made in an ordinary two-part molding box. This method gives as good results as when made in a three-part box, providing the boss is a little wider and deeper. Sometimes flanged pulleys are made with a pattern having a core-print all the way round the outside pulley face. After the pattern is withdrawn from the mold, a dry-sand core is then inserted in sections, stopping out all but the intended flange. The method shown is preferable.

"DOG DAYS" IN MOTOR FACTORIES.

In common with other motor car factories in Detroit, the Ford Motor Co. are "between seasons," the following notice which has recently been posted up and the suspension of several thousand workmen being ample evidence:

In the regular course of business, we have reached the slack or quiet season, and in line with our policy to be just and fair to the individual employee, we have planned as follows:

Employees will be given a leave of absence without pay, or, if you please, laid off for a period of 30 days. If, during the leave of absence or "laid-off period," the employee can find other employment, the company recommends that he do so.

If, at the end of 30 days, our men have found no other employment and desire to return to work, they may apply and the company will endeavor to find employment for them.

FORD MOTOR CO.

ANNEALING TEXTILE MACHINE CASTINGS.

In a paper read at the recent conference of the British Foundrymen's Association, it was stated that the cast iron used in spindle making was always annealed, and known under the generic name of "black iron." That cast from part hematite, or from iron with about In such a case there was practically no velvety fracture after proper annealing. ten times the quantity of sulphur concombined carbon present, all the carbon being in the form of graphite and annealing carbon. This complete separation of the carbon contributed largely to the iron having a velvety appearance when broken. An iron suited for these castings and combining the best average qualities for rapid production and long life in work would approximate to the following analysis:—Silicon, not exceeding 2 per cent.; phosphorus, not exceeding 1 per cent.; manganese, 0.85 to 1 per cent.; sulphur, 0.08 per cent.; total carbon, as high as possible.

Occasionally it was found that during annealing the castings had acquired an exceedingly hard white skin which no tool could touch, the interior of the casting was quite soft. As the outside of the castings could be readily filed before the anneal, and could not possibly be filed after, it was obvious that the hard skin was acquired during the process. It had been suggested that this hard skin might be due to oxidation, but there could not be oxidation of a casting perfectly covered with coke. In any case the oxide would be red.

The conclusions drawn were:

(1)—Non-continuous annealing ovens produce softer castings than do continuous ovens.

(2)—The hard skin which occasionally appears on the castings is due to the influence of excessive sulphur contained in the packing material. Also the sulphur originally present in the packing material is augmented during each subsequent heating, and this additional sulphur comes from the fuel used in firing.

(3)—Coke dust contains from five to ten times the quantity of sulphur contained in cast-iron borings and thus gets more quickly to the point at which it parts with sulphur to the castings.

(4)—If coke dust be used, an addition of lime retards the effect of the sulphur.

(5)—Coke dust sags during annealing more than cast-iron borings do, and with it warped castings are more common, especially if there has been overheating of the oven.

(6)—The packings should be changed often so that the sulphur may not reach the saturation point where is passes the sulphur into the castings.

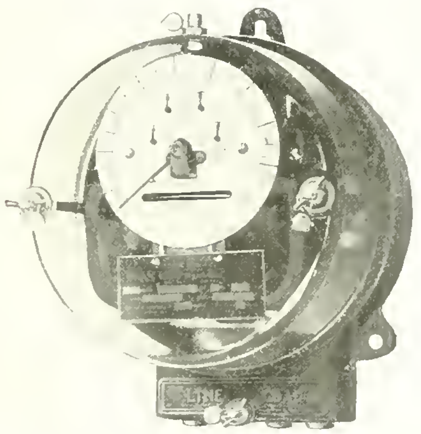
PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

WATT-HOUR DEMAND METERS.

FOR many years electric energy was sold altogether at a rate of so many cents per kilowatt-hour used, the rate depending solely on the quantity. Recent years have, however, seen a very decided change in this method of selling, and other factors are now given due consideration, the most important of these being the amount of energy called for or the demand. There has, therefore, arisen a need for a watt-hour meter to measure this value.

Such a demand meter, known as the type RO, has been recently placed on the market, its purpose being to meet the growing need on the part of central stations for an instrument to determine by a simple reading the maximum demand of an installation. This is a single meter which records without the use of



WATTHOUR DEMAND METER.

a clock mechanism both the kilowatt-hours consumed and the maximum kilowatt demand. Fulfilling both these purposes, it is an ideal meter for determining maximum demand and load factor as a basis for rates, as well as the diversity factor of the station. It provides precisely the readings needed on systems that base their charges on maximum demand and power delivered. Both readings can be taken monthly. The meter records the maximum demand of the connected load, but not the time at which the maximum occurs.

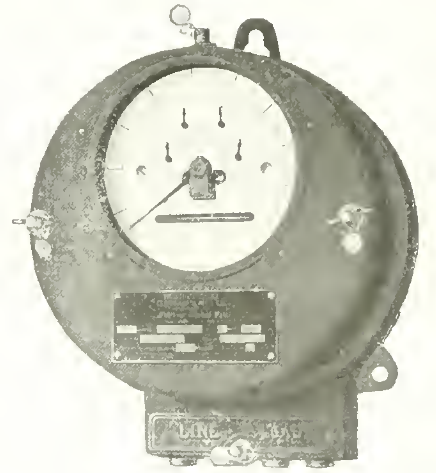
The watt-hour demand meter is installed in the same manner as an ordinary watt-hour meter, and requires no additional apparatus or wiring. The maximum demand is indicated by a pointer sweeping over a 4-inch dial, and the watt-hour load is recorded on a 4-dial counter. The instrument has no clock, contacts, or other delicate parts that are likely to require attention, and the mechanism is so simple that maintenance costs are but little more than those of watt-hour meters.

The meter is a combination of an induction watt-hour meter, an induction watt-meter, and an escapement form of time element. It has a standard Westinghouse Electric Co. type OA watt-hour meter movement, including electro-magnet, permanent-magnet and aluminum disk, and, in addition, has an auxiliary disk sector supported on a jewel-and-ball bearing, so that it can move in the air-gap of the electro-magnet in such a manner that it does not interfere with the accuracy of the main disk, which always rotates at a speed proportional to the load. The rotation of the auxiliary disk is restrained by a spiral spring, making its final deflection proportional to the watts load. The auxiliary disk with its spring and pointer constitute an indicating wattmeter.

The shaft of the auxiliary disk is geared to an escapement wheel, and the claw restricting this wheel is oscillated by an eccentric on the main shaft. The auxiliary disk, therefore, advances step by step at a speed determined by the speed of the main watt-hour meter disk—that is, at a speed proportional to the load. It continues to advance until the spring tension balances the torque produced in the auxiliary disk. The demand mechanism is then in equilibrium and the pointer indicates the watts.

As the total deflection and the rate of deflection of the auxiliary disk vary in direct proportion, the time required to reach the maximum position when any constant load is passed through the instrument is a constant. For example, if a load of 500 watts is supplied to a 5-ampere, 100-volt meter with 15-minute time element, the demand mechanism will reach equilibrium at the 500-watt point in fifteen minutes. If instead, however, a load of 1,000 watts is applied to the meter, the demand mechanism will have to move twice as far to the 1,000-watt point, to reach equilibrium; but the double load will move the watt-hour disk twice as fast, causing the escapement to allow the demand disk to move twice as fast, and it will cover the double arc in the same time. A mathematical analysis of the instrument shows that the deflection for any varying load that does not continue long enough for the instrument to reach equilibrium is equal to the average load during the interval.

The auxiliary disk drives the demand pointer through a dog, and a fine-toothed ratchet and pawl holds the demand pointer in the position of maximum deflection until released by hand. A second ratchet and pawl allows the auxiliary disk to fall back to equilibrium under its spring tension if the load falls below that corresponding to its position at any moment, but prevents it from advancing except as controlled by the escapement as before. The maximum demand pointer can be re-set instantly by pressing a sealed button on top of the cover. This raises the pawl that holds the pointer in its maximum position, and a light spring returns the pointer to zero or to the position of the auxiliary disk.



WATTHOUR DEMAND METER.

The type RO watt-hour demend meter is made by the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

NEW OSBORN AIR SQUEEZERS.

The line of portable air squeezers designed and built by the Osborn Mfg. Co., Cleveland, Ohio, continues to grow. The two larger sizes have for some time been furnished either as plain power squeezers or as power squeezers with jolt equipment added, and now the line is broadened still further. Both the plain machine and the jolt squeezer can be had with a stripping mechanism, this device being supplied with any of the three sizes.

The air squeezer which is the foundation of this machine series (three sizes) is marked by its notable ease of operation (being automatic in its application of power to the squeeze), the protection of every working part against dirt and dust,

its rugged strength and its simplicity. In the jolt squeezer (two sizes) there is a further advantage, of great value in many classes of work, in that a few jolts before squeezing prevent ram-offs and defective moulds, eliminate tucking, and also speed up production.

A stripping attachment is now regularly supplied, when desired, with either the squeezer or the jolt-squeezer type. Its advantages are obvious, as the stripping device operates automatically and gives a true, accurate draw without the employ-

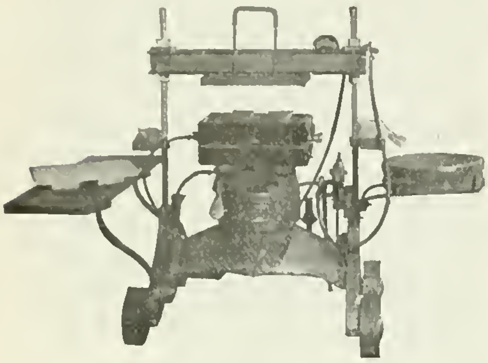


FIG. 1. PORTABLE AIR SQUEEZER, MEDIUM SIZE.

ment of skilled labor. The stripping operation is entirely automatic, but can be worked by hand without making adjustments or changes in the machine. It can be used either with or without tripping be used either with or without stripping able in and out, and also up and down, and are so located that adjustments can be made for any of a wide range of sizes up to the maximum flask-capacity of the squeezer. Any desired depth of draw can be secured.

The stripping operation is as follows: The flask is put on and the mould made

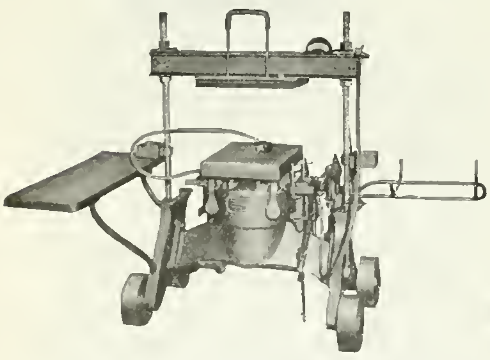


FIG. 3. PORTABLE AIR SQEEZER STRIPPED, MEDIUM SIZE.

as on the regular Osborn air squeezer—that is, the operator simply pushes down the handle of the operating valve, after which compression is applied up to the point at which the release valve has been set. Being released when that pressure is attained, the machine automatically returns to off position. The jolt, if used, is operated by a separate knee-valve. The stripping device is partly attached to the squeezing head and, as the head descends to make the squeeze, the stripping mechanism is raised to working position. After the mould has been squeezed and as the head is descending, the flask comes

FIG. 5. PORTABLE AIR SQUEEZER, NO. 74-W.

in contact with the stripping-pins and the pattern is automatically drawn.

It should be especially mentioned that the speed at which the flask is stripped

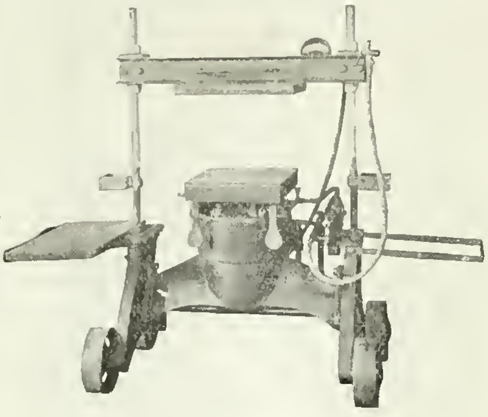


FIG. 2. PORTABLE AIR SQUEEZER JOLT, MEDIUM SIZE.

from the pattern is just one-half the speed at which the head is lowered; this makes for surety and accuracy. Another

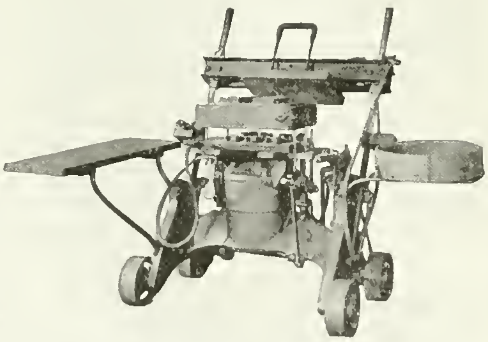
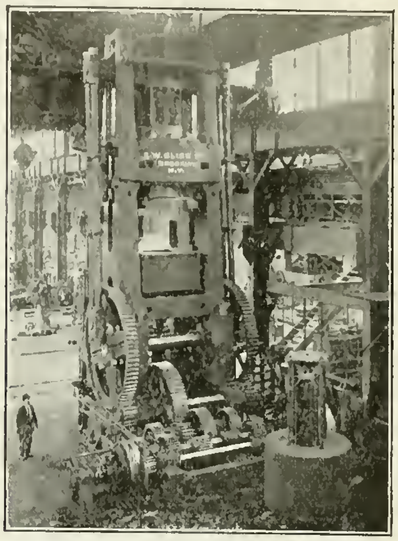


FIG. 4. PORTABLE JOLT STRIPPER AIR SQUEEZER, MEDIUM SIZE.

important point is that the speed at which the mould is stripped from the pattern can be anything from very rapid to very slow and easy—whatever conditions may demand.

LARGE BLISS DRAWING PRESS.

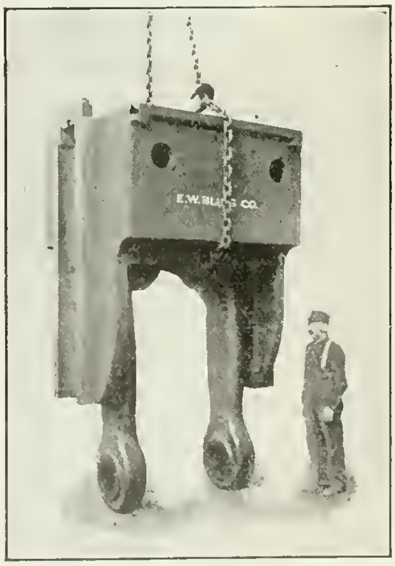
The press illustrated in the various photographs shown was recently designed and built by the E. W. Bliss Co., of Brooklyn, N.Y., and is among the larg-



REAR VIEW, SHOWING GEARS.

est drawing presses ever built. It is of tie-rod construction in which all the working strain is taken by large vertical steel tie-rods, has an extreme height of about forty feet, and weighs close to 650,000 pounds. A fair idea of its immense size may be obtained by the comparative size of the men seen in the illustrations.

The press was designed to draw steel shells as large as 48 in. in diameter. It will draw and lift out shells as deep as 40 in. and draw and push through shells 45 in. deep. When shells are lifted out, the positive bottom knockout which is stationary, but adjustable for the different



DIE TABLE AND TWO CONNECTING LINKS.

heights of shells, is used. Blanks as large as 64 in. in diameter and 3-16 in. thick may be drawn.

The table carrying the die is operated by a powerful toggle motion which connects to the two crank pins on the main gears. The plunger carrying the punch is operated by the steel cross-head, which is coupled by two double connecting rods to the crank pins on the main gears. The blank-holder is stationary. The plunger and blankholder adjustments are each accomplished by independent electric motors, there being a separate motor for each adjustment. Before adjusting, the blankholder is unlocked, and after adjusting is locked by an electric motor. All motors for adjusting are directly attached to the machine.

The entire train of gearing is of steel with machine-cut teeth. There are three ratios of gearing: 200:1, 100:1, and 67:1. By means of change gears, the speed of operation may be varied from 1½ to 3 and 4½ revolutions per minute as may be required for the different classes of work to be produced. The cross-head and bed are counterbalanced by a hydraulic accumulator which may be placed above or below the floor line nearby or as may be most convenient. The drive is by a 200-h.p. electric motor, while the control is by means of a powerful hand-actuated friction clutch of the double-grip type.

HUGE ORDER RECEIVED FROM CHINESE GOVERNMENT.

The Niles-Bement-Pond Co., of New York, has been awarded a contract amounting to over $1,000,000, by the Chinese Government for the complete equipment of a small arms arsenal at Hanyang (near Hankow), China. The machines will be built at their Pratt & Whitney Works, Hartford, Connecticut, in a special department exclusively devoted to the manufacture of this particular type of equipment.

The Niles Company was in competition with the large gun machinery manufacturers the world over. As in the case of the new Australian Government rifle factory which was completely equipped by the Pratt & Whitney Works, the delivery limit together with the efficiency of the proposed equipment and the production time guarantee were again the deciding factors. The contract calls for machinery to produce 100 complete army rifles per day and a considerable amount of other military equipment. It will include metal, wood, and leather working machinery, fixtures, gauges, etc. All parts must be so accurately made that they will be absolutely interchangeable, thus insuring the perfect working of each gun in time of action.

As already stated an important factor in the securing of this contract was the guarantee of production. Under present conditions in China, 90 hours actual time is required for producing each complete rifle while, with the new equipment, the time guaranteed is less than 23 hours.

The plans for the Chinese arsenal are such that no one man will perform more than one or two simple operations and therefore will soon become proficient on just that class of work. Experienced engineers and gun makers from the Pratt & Whitney Works will instruct the Chinese workmen after the equipment is installed.

While the terms of payments have necessarily been made to suit the present financial situation of the Chinese Government, the Company feels confident—as a result of their representative's report—that the stability of the existing Government is assured and that they will soon be in possession of adequate revenues, as a result of the reforms and economies which are now being effected.

The government arsenals equipped by the Pratt & Whitney Works in England,

MAIN GEARS

Germany, France, Australia, Belgium, etc., etc., as well as the United States Government arsenals at Springfield and Rock Island, speak well for the years of patient study which this concern has devoted to the important work; the one thought ever uppermost being "How can we improve our designs in order to produce a better gun in a shorter time."

Various other works of the Niles-Bement-Pond Co., make a specialty of machinery for the manufacture of heavy ordnance and armor plate. A gun lathe for machining ordnance up to 16 inches bore has recently been shipped by them to Austria; ten freight cars being required to carry this one machine from their Philadelphia works to the seaport. Several of these large gun lathes have been built by them for the Italian Government arsenals and a number of very large lathes, boring and turning mills and planers have recently been shipped to England, France and Germany.

In view of present business conditions, the Niles-Bement-Pond Company, is to be congratulated on the receipt of recent orders from abroad for a large number of railway wheel and axle machines, as well as machine shop equipment. The Niles' 36-foot boring and turning mill ordered for the United States Navy Yard, Brooklyn, is being set up. Thirteen large freight cars were required to carry the various parts of this machine.

In a recent shipment to France was included the largest boring and turning mill ever exported from the United States.

Pigeon, Pigeon & Davis, Patent Attorneys, Montreal, report that 122 Canadian Patents were issued in Canada on May 26th, 1914, 83 of which were granted to Americans, 28 to Canadians, 7 to residents of foreign countries and 4 to residents of Great Britain and Colonies. The following is a full list of those patents issued to Canadians:—

C. Wokes, Toronto, Ont.: "Brick Making Machines."

C. G. Ashley, Toronto, Ont.: "Perforated Tape Reproducers."

A. W. Laberre, Bulwer, Que.: "Lightning Rods."

G. T. Reiss, Hamilton, Ont.: "Wheel-press Tail-blocks."

J. Carmichael and R. Whipps, North Vancouver, B.C.: "Devices for pulling on shoes."

G. Francis Armstrong, Hamilton, Ont.: "Heaters for Incubators."

H. N. Bingham, Indian Head, Sask.: "Automobile wheels."

F. A. Breeze, Newburgh, Ont.: "Clamping screws and operating mechanism."

A. M. Brotherston, Winnipeg, Man.: "Sheet Piling."

W. A. Dodge, Toronto, Ont.: "Flexible pipe connections."

W. C. Ferguson, Calgary, Alta.: "Conduits."

W. W. Glover, Granum, Alta.: "Shade-rollers and curtain-rod supports."

C. E. Hilton, Toronto, Ont.: "Instep arch supports."

C. E. Hilton, Toronto, Ont.: "Massage instruments."

J. Humphreys, Winnipeg, Man.: "Hair pins."

A. J. Jensen, Vancouver, B. C.: "Measures."

J. P. Marois, Montreal, Que.: "Window ventilators."

J. S. Miller, Truro, N.S.: "Railway tites and railway fastenings."

M. P. McNeely, St. John, N.B.: "Seat hinges for closets."

E. Pape, Vancouver, B.C.: "Railroad spikes."

Wm. Eric Phillips, Toronto, Ont.: "Electrolytic baths for plating brass."

E. W. Setterlund, Sandbridge, Man.: "Saw sets."

J. A. Sullivan, Victoria, B.C.: "Automatic ships' telegraph alarms."

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Vol. XI. JUNE 18, 1914 No. 25

PRINCIPAL CONTENTS.

LACK OF BUSINESS MEN IN PUBLIC LIFE.

THAT Canadian business men shun public life, or to be more specific, the political and municipal feature of it, is, to say the least, regrettable, because they thereby encourage a condition of things in these particular spheres that can only be expressed as deplorable. As was aptly stated by the retiring president of the Canadian Manufacturers' Association at their recent convention in Montreal, there are too many lawyers and farmers in our legislatures, and while in many respects these may be very estimable gentlemen, it is a notorious fact that they are heartily out of sympathy with what is after all the back-bone and sinew of our nationality, the manufacturing and industrial community.

A sample of sublime ignorance in this respect was the effort of the Postmaster-General to burden particularly the publishers of technical journals by increased postage on their product. The above genius failed to appreciate, he most likely never knew, until his attention was drawn to it, that the cream of our youth and the pick of our manhood depend meantime as hitherto for being kept posted on and educated in the intricacies of their varied trades, on these very periodicals he sought to raise in productive cost and therefore purchase price.

THE BUSINESS SITUATION.

THE one outstanding conclusion from the many that have been drawn relative to the unfortunate industrial situation in which this Dominion finds herself to-day is that during the past five years we have been hitting a too rapid pace.

With a monotonous regularity and intonation, bank, association and company annual meetings have been told that we were going ahead much too fast for our resources, and that the present condition of affairs is none other than the reckoning time for our indiscretions. One of the most interesting features in all of this out-pouring is that expressed by the little but all-embracing pronoun, **we**. It reminds us of a number of apprenticeship experiences in which, when some achievement was accomplished, the foreman declared himself alone personally worthy of the honor, but if error, followed by trouble, happened to be the outcome, then **we** brought it about, and not he; oh no.

To our mind there is too much generalisation as to the cause and responsibility for the existing depression in our midst, and too little tendency to apportion or even appropriate the blame. It is neither a question of democracy nor aristocracy, but it is an attitude of our financial and business magnates which has been proven to be altogether wrong. In certain departments and spheres of activity the most highly developed and concentrated efforts are being made to secure efficiency, but who shall say that our national purse strings have been adjusted to maintain the proper balance between our resources development and the capital outlay.

Our citizens for the most part are blissfully unconcerned as to the "why and wherefore" of this depression period, their principal questionings being relative to its passing, and most of them, particularly those who have passed through similar periods, have come to look on each recurring occasion with more or less resignation. However any of us may view the present business situation, complacently or ready to blame, there is little likelihood of anything miraculous being seen in the display of caution when the next boom begins; rather is there to be feared a repetition, on an even more advanced scale, of reckless optimism. History generally repeats itself.

The end of much unnecessary parleying at Ottawa, with its for the most part politically suspicious insincerity, and the decision to guarantee the bonds of the C.N.R. to the extent of $45,000,000 brings already indication of an impetus to our low ebb industrial situation. An order has just been placed with our big steel corporation for 45,000 tons of steel rails by the above road, and in addition to this we are informed that further tonnage is in sight.

Why the long drawn-out discussion on this guarantee question? It is beyond the wit of man to conceive, as aside altogether from the two men most intimately involved, and round whom the battle, if we might call it so, was really fought, neither government nor opposition had the slightest excuse, except it were incapacity to appreciate the industrial situation, to play fast and loose as they did.

INDUSTRIAL NOTABILITIES--No. 39

CHARLES NEWTON CANDEE, vice-president and managing director, Gutta-Percha & Rubber Co., Ltd., Toronto; secretary and director the Toronto Rubber Co., Ltd.; secretary and director the Winnipeg Rubber Co., Ltd., and secretary and director Vancouver Rubber Co., Ltd., was born at Rochester, N.Y., March 2, 1860, the son of James Goodrich Candee, merchant, Syracuse, N.Y., and Mary F. (Ackerman) Candee. He came to Canada and settled in Toronto, Oct. 28, 1886, and was naturalized as a British subject.

Mr. Candee commenced his business career as clerk in the wholesale and retail rubber establishment of O. W. Clary, Syracuse, N.Y., 1879; remained there in various capacities until October, 1886, when he received the appointment of assistant manager Gutta-Percha & Rubber Mfg. Co., Toronto. He was appointed secretary of the company Jan. 26, 1889, and when the business was reorganized Jan 1, 1913, he became vice-president and managing director.

CHARLES NEWTON CANDEE

His entire business career has been devoted to the rubber industry with which the family name has been identified since its earliest stages; the first license to manufacture rubber goods under his patents being issued by Charles Goodyear to Leverette Candee.

He is a member Toronto Board of Trade, and governor Toronto Conservatory of Music, and married Anna Park Taylor, daughter of Washington S. Taylor, Memphis, Tenn., April 20, 1892, by whom he has one son and three daughters.

His clubs are the York, National, Royal Canadian Yacht, Lambton Golf and Country, Rosedale Golf and Canadian.

He is warden, St. Paul's Anglican Church, Toronto, and his residence is at 59 South Drive, Toronto, Ont.—Photo, Courtesy International Press.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh	$13 65	
Lake Superior, charcoal, Chicago	16 00	
Ferro Nickel pig iron (Soo)	25 00	

	Montreal.	Toronto.
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 75	18 10
Victoria, No. 2X.......	18 50	17 85
Victoria, No. 2 Plain ..	18 25	17 60

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh............	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh..........	1.15
Beams and angles, Pittsburgh....	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base..	$2 15	
Cut nails	$2 60	2 65
Miscellaneous wire nails...	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb. off
Nuts, Hexagon, all sizes..	4½ per lb. off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright	85, 10, 7½, 10, 10 p.c. off
Wood screws, flathead, Brass	75, 10, 7½, 10 p.c. off
Wood screws, flathead, Bronze	70, 10, 7½, 10 p.c. off

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Standard. Price. per ft.	Extra Strong. Sizes Ins.	Extra Strong. Price per ft.	D. Ex. Strong. Size Ins.	D. Ex. Strong. Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

Standard	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 75	$15 75
Electrolytic copper	15 50	15 50
Casting copper	15 25	15 45
Spelter	5 25	5 25
Tin	34 50	35 00
Lead	4 85	5 25
Antimony	8 50	8 50
Aluminum	20 00	19 00

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double...	60%
Standard	60 & 10%
Cut leather lacing, No. 1	

BELTING RUBBER.

Standard	60%
Best grades	30%

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28........	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright....	3.90	4.00
Apollo brand, $10\frac{3}{4}$ oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G. ...	4 30	4 65
Fleur-de-Lis, 28 B.W.G. ...	4 10	4 45
Gorbal's Best, No. 28......	4 40	4 65
Viking metal, No. 28......	4.00	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt. casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal. ..	0.21
Benzine, per gal.	0.20
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled...............	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough, Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Montreal, Que., June 15, 1914.—There has been very little change in the business outlook, and reports generally are that trade is still quiet and little is being done in the way of construction. While there is a disposition on the part of most people to look hopefully to the future, it has to be admitted that at the present time there is a marked dullness.

Locally, there is considerable construction going on, notably the Sun Life Building, the National Trust Building, the new Imperial Bank, while several theatres are projected in the uptown district. One of the latter, which will be built by the Keith interests, will have a seating capacity of over 4,000. In the residential districts there is also quite a lot of construction work under way, and it is notable that a number of new apartment houses are being erected of reinforced concrete. This has resulted in large sales of concrete mixers to contractors. So far as machinery is concerned, the principal business of late has been in contractors' supplies and municipal equipment, such as road-making machinery, etc.

A representative of one of the big machinery supply houses, who was in Ontario last week, said he was greatly impressed with the work being carried on at the new Welland Canal. It is understood, however, that contractors' supplies have been pretty well bought up for this work.

Metals.

The metal markets continue to show a general weakness, the only exception being lead, which has shown some strength lately, especially in London, due largely, it is stated, to the Mexican situation. The market for pig iron is at a low ebb, and, according to some authorities, has about reached the bottom. Buying has been light, and it is understood that many of the big companies have instructed their purchasing agents to buy only for immediate needs at present, evidently being satisfied that there is little reason to anticipate higher prices for a while. During the last week some big American contracts were closed up, but this is not classed as new business, as in every case the orders had been hanging fire for several months, and were only closed now that the market was considered more favorable.

There is a feeling that an improvement will be experienced in business in the very near future. It is felt that in view of the Canadian Northern getting their aid from the Government, and the Grand Trunk getting their bonds guaranteed, that there will soon be some business developed. It is known that both roads are contemplating the building of new cars, and when this work comes through it will be a means of brightening up the situation. The C.P.R. is not doing a great deal of car building at the present time; a large number of their hands being still laid off and the shops working at reduced pressure.

Toronto, Ont., June 16, 1914.—No change is to be observed in trade conditions this week. As an improvement was hardly to be expected, there will be no disappointment. The general opinion seems to be that quiet times will be the rule until the fall, when, providing the crops are good, some improvement will be felt. If, at the same time, the foreign outlook brightens, there should be an upward movement in export as well as internal trade.

Charles B. Gordon, in his presidential address delivered before the Canadian Manufacturers' Association in Montreal recently, gave some good advice on the necessity of more economical methods of production and development. If this advice is taken to heart and practised in good as well as in bad times, the country generally will derive much benefit, and development will proceed on a sounder footing.

Expenditures are now being made on a more conservative basis and the depression will no doubt show the necessity of exercising economy in methods of raising capital as well as in the spending of it. The temporary check in progress should eventually prove of the greatest benefit to the Dominion.

Steel Market.

Conditions in the steel and iron market have not improved, business still being very quiet. There are, however, indications that there will be some revival within the next two or three months. The building permits for May show a decrease over the corresponding month last year. The building trade is quiet and there is little demand for structural steel.

The bills for granting assistance to the C. N. R. and the G. T. P. have passed the Senate, and a large amount of money will be released for expenditure on these roads. It is reported that the C. N. R. have already placed a large contract for rails with the Dominion Steel Corporation, amounting to nearly one and a half million dollars. Orders for equipment such as locomotives and cars will no doubt follow. It is highly probable that the G.T.P. will come into the market soon for material, but not to as great an extent. The expenditure of so much money will have a beneficial effect on business generally.

Reports from Pittsburgh and Chicago state that business is improving and that several substantial orders have been placed recently. There appears to be a feeling that the worst of the depression in the steel trade has been reached and that prices have reached their lowest.

Pig Iron.

The pig iron market is quiet with no change in prices. Buying is of a hand-to-mouth order, consumers not being

anxious to carry heavy stock with trade in its present condition.

Machine Tools.

The machine tool business is also quiet, a few small orders only being placed. Comparatively few new machine shops are being put into operation and the majority of the existing plants have enough tools to keep them going.

It is probable, however, that the C. N. R. will soon be in the market for machine tools, as specifications were prepared early in the year but never issued. A local dealer reports having sold 14 tumbling-barrels to the Massey-Harris Co. for their Brantford, Ont., plant. The mills will be made by the R. McDougall Co., of Galt. The Toronto Street Railway have purchased a "Ryerson" special combined punch and shear, fitted with a coping attachment.

Metals.

The general condition of the metal market shows quite a little improvement. More business is being done, but in small lots. There is no change in prices this week.

Ottawa, Ont., June 15, 1914.—A valuable inquiry into the possibilities of South African trade has been made by W. J. Egan, Canadian Trade Commissioner for South Africa. He makes an extensive report on the machinery and hardware trade of South Africa, which is at the present time almost entirely in the hands of Great Britain, Germany and the United States. The greatest increase in Canadian trade is possibly in automobiles. While the total trade has doubled since 1912, Canada has increased her trade more than threefold. In 1913 Canada exported to South Africa motor cars to the value of £157,178. Mr. Egan, in giving advice to exporters, says:—

"Correspondence from all Canadian firms seeking an export market should include complete information in the first letter in reference to the following particulars: Catalogue or list with same; the f.o.b. prices Montreal or St. John; how the goods are packed and in what quantities; size of case or parcel, and weight; season of delivery; if no arrangement with other Canadian manufacturers for representation is made or direct representatives sent, what commission will be paid; what will be allowed per year for guarantee on missionary work; how lines are sampled; if machinery, will aluminum or other models be sent; is the line advertised, and if so how much is allowed per annum; what means of advertising is recommended, also an arranged cable code if necessary. With information of this kind and any other that may suggest itself it is possible to place the proposition before interested parties in such a way that business must result much more quickly than under present conditions where little or no information is offered."

Trade figures just prepared by the Trade and Commerce Department giving details of the commerce of Canada for the twelve months ending March 31, show that there was a decrease in iron and steel imports of some $19,000,000. The imports in iron and steel and manufactures thereof, were $138,648,364 for the 1913 period, as against $119,221,241 for 1914. Brass and manufactures of brass imports were $5,288,082 in 1913, as compared with $4,415,202 in 1914. Copper and manufactures of copper imports in 1913 were $7,548,530, and in 1914 they were $6,581,485. Tin and manufactures of tin imported were $7,242,494 in 1913, as compared with $6,581,485 this year. As for exports of metals and minerals and manufactures thereof, there was a decrease from $27,225,694 in 1913 to $25,041,352 in 1914.

Winnipeg, June 15, 1914.—L. C. Williams, Biggar, Sask., has written our western office asking where he can purchase brickmaking machinery, and a stationary engine of from 25 to 50 horsepower. He stated that he will require these in a hurry. The brick-making business seems to be thriving in the West, as several machinery brokers are figuring on new plants.

The Medicine Hat Radiator Co., have been contemplating the erection of a plant in Medicine Hat, Alta., for two years or more, but have now reached the stage at which they will probably buy the necessary equipment. Several Winnipeg houses are figuring on same. Carey Wright is one of the heads of the new enterprise.

Machine tools are probably in less demand just now than they have been for many years. The demand for grain elevator equipment has, however, been unusually good of late. Steam goods are very quiet.

The Stuart Machinery Co., this week sold the Stuart-Arbuthnot Lumber Co., Winnipeg, a 40 h.p. motor to drive their new plant. The Manitoba Rolling Mills, Selkirk, are buying an engine and generator as well as several motors. This will about complete their equipment.

St. John, N.B., June 13, 1914. — The contract for the construction of the foundation of the new buildings and wharf at West St. John, has been awarded to the Maritime Dredging & Construction Co. The Minister of Public Works has also authorized a call for tenders for the superstructure of the new shed to be erected. Steel will be used in the buildings which will be about 135 feet wide and 800 feet long. M. W. Doherty, general manager for the Maritime Dredging & Construction Co., said last night that there were now two reclamation plants at work with 470 men.

George McArthur, contractor, of St. John, has been given the contract for the erection of a new armory at Sussex, N. B. His tender was between forty thousand and fifty thousand dollars. The new drill hall and armories will be of two storeys. It will be 136 feet in length by 66½ feet in width. Ground will be broken in a few days.

The corner stone was laid this week for the new post office to be erected at Milltown, N.B. The building will be a large brick edifice of two storeys. Joseph McVay of St. Stephen, N.B., is the contractor.

The big steam shovel to be used in the excavations for the new pulp mill of the Bathurst Lumber Co., at Bathurst, N. B., is now on the ground and work will be started in a few days. Workmen are now engaged drilling at the site of the mill, preparatory to a start on the foundations.

CANADIAN MANUFACTURERS' ASSOCIATION CONVENTION.

The annual convention of the Canadian Manufacturers' Association, held in Montreal last week, showed, in spite of the general business depression throughout the Dominion, that progress and prosperity had been the lot of the Association during the year just closed. Naturally trade conditions occupied a prominent place in the remarks of different representatives, and numerous observations were made as to not only a prevention of such important occurrences, but relative also to the immediate outlook for a revival.

A distinct warning was given the delegates that if they were unreasonable in their tariff demands it might lead to either a disunited Canada, or else to a tariff revolution such as had recently been experienced in the United States. This warning was given by Mr. Charles A. Dunning, manager of the Saskatchewan Co-operative Elevator Company, who came as a representative of the Saskatchewan farmers to present their ideas to the eastern manufacturers. Mr. Dunning's address was greeted with prolonged applause, while the chairman congratulated him on the moderate and reasoned manner in which he had presented the views of the western farmers.

As mentioned elsewhere in this issue, the question of a larger percentage representation of manufacturers in our legislatures came up for discussion, and while all were generally agreed on the necessity for same, little encouragement was evident from those on whom the choice would fall.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Edson, Alta.—It is proposed to install an electric light and power system at a cost of $40,000.

Wolseley, Sask.—It is proposed to make extensions to the electric lighting system at a cost of $4,000.

Winnipeg, Man.—The Oribo Manufacturing Co. will erect a factory for making metal products. The cost will probably be $9,500.

Rock Island, Que.—The Union Twist Drill Co. will build a machine shop here. C. L. Chamberlain, of Worcester, Mass., is the architect.

Quebec, Que.—The Ross Rifle factory will be moved to St. Sauveur near here where 153 acres have been purchased at a cost of $20,000.

Benito, Man. — The Benito Machine Works have added very extensively to their plant, and are now in a position to handle every branch of machine repair.

Medicine Hat, Alta.—Preparations are being made for continuing the construction of a plant for the Dominion Sanitary Foundry Co., which was commenced last year.

Cobalt, Ont.—The York, Ontario, Silver Mines, Ltd., have increased the capital of the company to $1,500,000. Extensive developments are proposed and an electrically-driven air compressor may be installed.

Estevan, Sask.—Tenders will be received up till July 1, for the supply and erection of generators, exciters, gas engines, and a switchboard. Plans and specfications may be obtained from S. G. Lethbridge, Town Electrical Engineer.

Lethbridge, Alta.—The Petrie Mfg. Co., of Guelph, Ont., have selected Lethbridge as a distributing point for their cream separators and farm machinery. The company will build a warehouse here.

New Glasgow, N.S.—The Acadia Coal Co., of Stellarton, N.S., are making considerable extensions to the plant at the Allan Shaft. Some equipment, including an air compressor, has already been purchased.

Saskatoon, Sask.—The tenders for new boilers which were called some time ago will now come up for consideration by the Council, as the by-law authorizing the purchase was recently carried, at the second vote.

Toronto, Ont.—The Polson Iron Works on the Esplanade at the foot of Sherbourne street was visited by two disastrous fires Sunday morning, entailing a loss of about $20,000. The first fire which completely gutted the blacksmith shop, broke out early in the morning, and was the cause of the second blaze, which partially destroyed the machine shop. The loss in both cases is covered by insurance. The progress of the work at the plant will not be interfered with.

TENDERS FOR MACHINE TOOLS.

The Victoria Government Railways, Australia, are calling tenders as follows:—

Grinding machines and accessories.
Heading and forging machines and accessories.
Double head screw machine and accessories.
Steam hammer.
Radial drill.
Splitting shear.
Axle journal turning lathe.
Automatic stud machine.
Hexagon turret lathe.
Iron frame, sash, door and blind clamping machine.
Paint grinding mill.
Horizontal hollow chisel mortiser.
Shaping machine, single head.
Improved general joiner.
High-speed radial drill.
Single end punch and shear.
Double head bolt screwing machine.
Gap lathe, high speed.
Single spindle sensitive drill.

Tenders will be received in Melbourne up to September 2 1914, and should be forwarded by mail-boat leaving Vancouver on August 5, 1914. Manufacturers not having agents in Australia, can submit tenders through the Imperial Export Co., who have branches in Toronto, Ont., and Melbourne, Australia. Further particulars can be obtained from the Department of Trade and Commerce, Ottawa, Ont.

Municipal

Brock, Sask.—The Council may buy road machinery.

Welland, Ont.—It has been decided to install a fire alarm system.

Fort Erie, Ont.—It is proposed to install a sewage disposal system here.

Sydney, N.S.—The Council have decided to appropriate $16,000 for a fire hall.

St. Mary's, Ont.—The Perth County Council have voted $20,000 for road improvements and $6,000 on bridges.

Nanaimo, B.C.—The town will probably spend $30,000 on waterworks extensions.

Winnipeg, Man.—A by-law will probably be voted on to authorize the Winnipeg Omnibus Co., to operate a service of motor buses.

Alberni, B.C.—Two by-laws have been carried, to raise $15,000 for an electric lighting system and $12,500 for waterworks extensions.

Battleford, Sask.—The construction of waterworks is proposed by the town council. Permission has been granted by the Provincial Government to raise the sum of $30,000.

Minnedosa, Man.—The ratepayers carried a by-law on June 5, to guarantee the bonds of the Minnedosa Power Co., to the extent of $50,000.

Victoria, B.C.—Over sixty applications for the position of industrial and publicity commissioner for the recently organized Victoria and Island Development Association have been received.

Port Alherni, B.C.—The following by-laws will be voted on by the ratepayers on June 18: Street improvements, $10,000; bridge building, $6,000; municipal buildings, $7,500; electric light extensions, $10,000.

Chatham, Ont.—The city will probably buy a motor fire truck. The necessity of buying such equipment was urged at a council meeting, held recently, by Fire Chief Pritchard.

Victoria, B.C.—It is proposed to build a town hall and fire station at Esquimalt. The cost is estimated at $30,000, which includes $15,000 for the town hall, $5,000 for fire station, and $8,000 for firefighting apparatus. A by-law will be voted on shortly.

Orillia, Ont.—A by-law will be voted on June 18, to install a new filtration plant. The by-law was discussed at a public meeting Saturday, and Dr. McCullough spoke on different filtration plants and results. The maximum cost is estimated at $25,000.

Port Arthur, Ont.—Secretary Goodier of the Board of Trade sent five hundred new publicity folders to be distributed on board the steamer Noronic when she left Sarnia on June 13 for Port Arthur.

Saskatoon, Sask.—Heenan & Froude, Ltd., who were recently awarded a contract for an incinerator at $70,000, have submitted a revised tender at $100,000. It is probable that the new tender will be accepted but nothing will be done until the expenditure of the extra $30,000 has been authorized by the ratepayers.

Transcona, Man.—On June 6 the electors carried three important money by-laws, authorizing the expenditure of the sum of $425,000. The by-laws called for the expenditure of $115,000 for water works system and fire protection, $100,000 for sewerage system, and $25,000 for incinerator. The $100,000 to cover sewerage does not include the distribution system, which will be assessed as local improvements.

Lethbridge, Alta.—The following by-laws will be voted on by the ratepayers on July 3. Powerhouse extensions, $3,611; electric light and power line extensions, $12,834; street railway extensions, $3,691; elevator in industrial building, $2,300; water meters, $37,484; completion of high pressure water system, $31,865; new intake to waterworks system, $19,550; new water services, $3,450; water mains, $3,450.

Montreal, Que.—The annual meeting of the Montreal Water & Power Co., was held on June 10, when the report of the operations of the company for the past year was presented by the president Edwin Hanson. The old board was re-elected as follows: Edwin Hanson, president; T. J. Drummond, vice-president; and William Hanson, A. F. Riddell, John MacFarlane and T. Bienvenue.

Saskatoon, Sask.—On June 5, the following by-laws were carried: Site for new power house, $15,000; electrical extensions, $200,000; exhibition buildings, $10,000, and police patrol system, $10,000. These by-laws were turned down by the citizens on May 1, but it was decided to have another vote as it was thought that the necessity of having these improvements was not properly understood by the ratepayers.

Regina, Sask.—As a result of a couple of propositions brought before the finance committee by Industrial Commissioner McInnis, the finance committee decided to recommend to the city council the advisability of taking a plebiscite of the ratepayers as to the policy which shall be followed by the council in offering inducements to industries. It will also be recommended that a by-law be submitted asking permission to raise money on debentures to provide funds for the erection of warehouses, which would then be sold on terms to good concerns who might wish to locate in Regina. It is proposed to take this step on account of an anti-bonusing law which was put in force last February.

Sarnia, Ont.—The industrial committee reports that they are in communication with two industries located in the United States, and had received a visit from representatives of one of these. The industry already has a good trade in Canada and is rated for half a million in their home plant. They seek a vacant building in which they can commence building a line of machinery, but were unable to find a suitable building vacant in Sarnia. An effort is being made locally to have a building erected on a rental basis and another visit will be made shortly by one of their officials. The other industry seeks to purchase fifteen acres of land on a railway siding, and has asked replies to a list of questions regarding Sarnia as a manufacturing point.

General Industrial

Toronto, Ont.—The Gutta Percha and Rubber Co. will make an addition to their factory.

Sherbrooke, Que.—The Canada Cement Products Co., will probably locate here. Mr. Parker is interested in the company.

Orillia, Ont.—Fire destroyed McAlarys Bros.' boat factory on June 10. The loss is estimated at $2,000, partially covered by insurance.

Oakville, Ont.—The by-law granting the Glassco Jam and Preserve Mfg. Co., exemption from taxation and free water for a period of ten years will be voted on June 22, and will undoubtedly carry.

Waterloo, Ont.—The ratepayers will vote on the industrial by-law providing for a loan of $15,000 and other minor concessions to the Doering Trunk Co., Ltd., on Friday, July 3. The proposition has been approved of by the Board of Trade and Town Council, and little opposition has been voiced against it among the citizens generally.

Windsor, Ont.—The by-laws voted on to grant exemptions to the Canadian Zagelmeyer Co., and Maul & Riggs Co., were carried on June 5. The Maul & Riggs Co. have already started up an artificial stone plant on the No. 1, factory district.

Medicine Hat, Alta.— Not less than $100,000 is to be spent by the Lake of Woods Milling Co., for extension and improvements on their newly-acquired plant here. It is expected to double the present capacity of the mill, greatly increase the warehouse facilities and enlarge the elevator capacity to three times the present size.

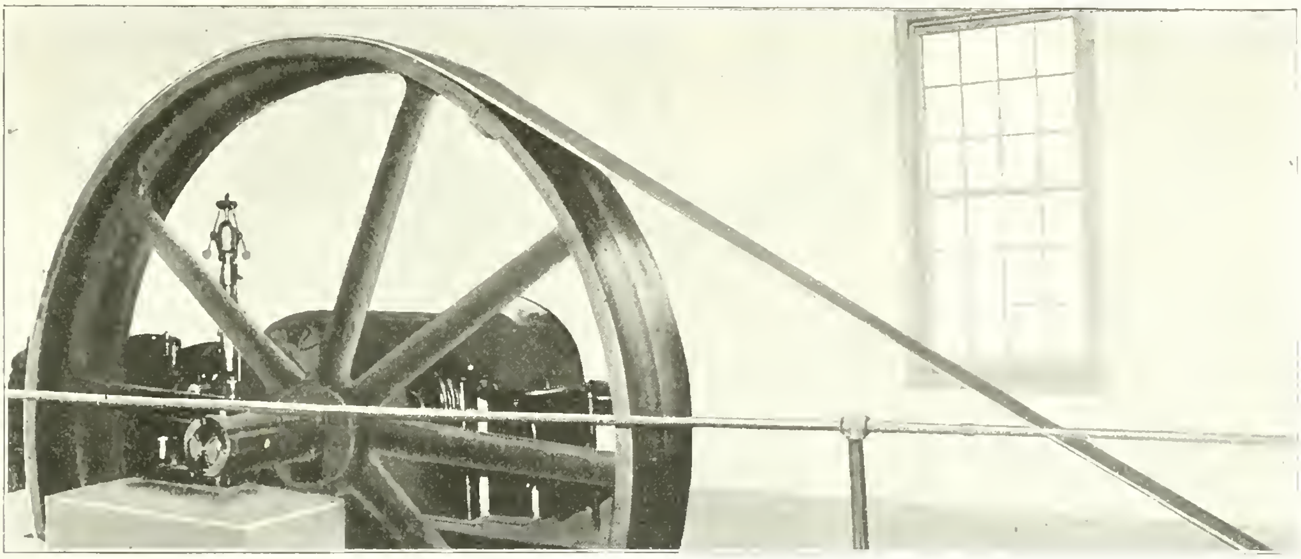
Victoria, B.C.—Within two weeks the city will make a start on the trenching work for the steel pressure pipe line to be laid from the city to Humpback Reservoir for the Sooke Lake water works system. A camp is now being formed, and it is expected that, when work is underway, from 100 to 125 men will be employed. The contractors for the steel pipe fabrication, the Burrard Engineering Co., are rapidly getting ready the plant at Thetis Cove, Esquimalt Harbor. Some additional plant has been brought over from Vancouver, and the delivery of the fabricated sections will shortly commence.

Montreal, Que.—The directors of the Premier Glass Co., of Canada, Ltd., the new concern whose offering of $900,000 preference stock in London the other day came somewhat as a surprise here, are Sir Douglas C. Cameron, Winnipeg; R. B. Bennett, M.P., Calgary; A. W. Fraser, Ottawa; G. T. Somers, Toronto; G. A. Simard, Montreal; with two English representatives, Sir James Pender and John R. Payne. The company is to have plants at Montreal, Selkirk, Man., and Regina. As construction of the eastern factory here is stated in the London prospectus to be 85 per cent. accomplished, and the situation of the plant is given at St. Pierre aux Liens, apparently it is through this new company that the Atlas Glass Works is to be re-organized. Bondholders of the later company meet on July 3 to pass on a reorganization plan.

Tenders

St. Lambert, Que.—Tenders will be received up to June 22, 1914, for the supplying of a hot bituminous concrete mixer. Specification may be obtained from E. Drinkwater, town engineer.

Toronto, Ont.—Tenders will be received up to June 23, for the supply of two tandem steam road rollers. Specifications may be obtained from purchasing department, City Hall.



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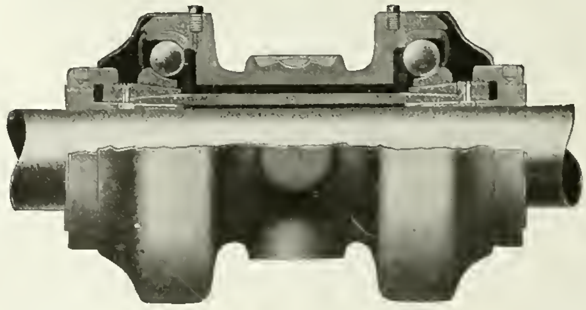

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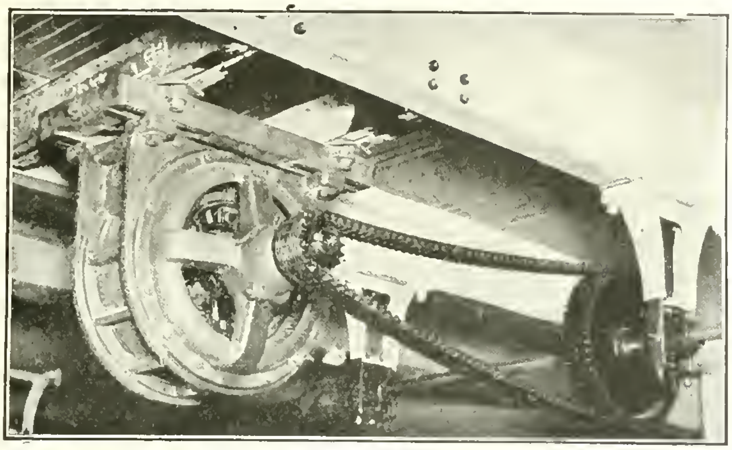

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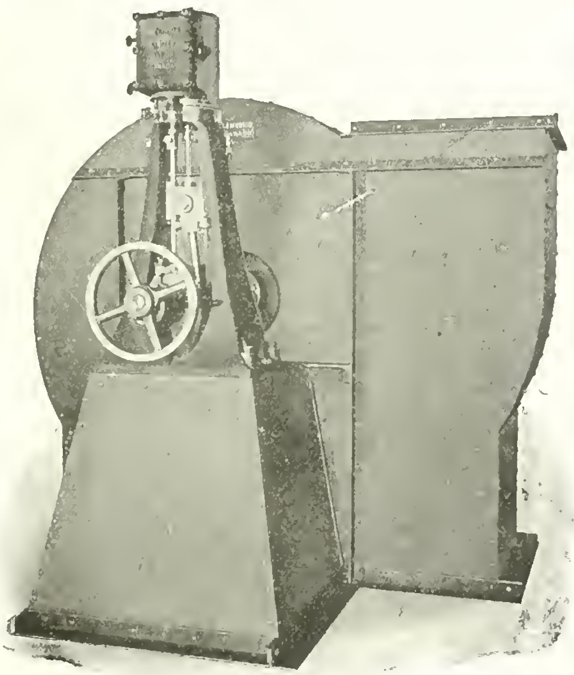

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Management--The Strenuous or Rule-of-Thumb Type

By E. St. Elmo Lewis *

The present is the first of a series of three articles which will deal with the subject of management as exemplified in three different types of men—the strenuous, the systematic and the efficient. The points brought out relative to the useful accomplishment of each are worthy of careful study.

IT IS important for us to recognize in the very beginning of any consideration of the question of costs, that a cost system does not unfold itself as a logical consequence of starting a business with a bookkeeping department. A cost department is an entirely different unit. A cost system is not based upon the pre-determined scheme of things which flow from one to another in an inevitable and logical sequence. A cost system is the reflection of a man's mind, of his manner of thought, of his education, of his sympathy, of his training and experience, of his ability to manage, to analyze, to synthesize, to coordinate, to harmonize, to grasp things in detail and in the large. We understand that cost keeping at its best is an efficient method of determining exactly what time, work, and material is put into the production of any marketable energy, commodity, or service.

Do not make the mistake of thinking that manufacturing is limited to things that you can weigh on scales or measure with a foot rule. The electric light company manufactures a product as well as the automobile manufacturer. The railroad company manufactures a product as well as the hat manufacturer. The department store cannfactures a product, and so does the doctor, the lawyer, and the advertising manager.

The mere fact that in some of these a definite standard of measurement has not been obtained, does not preclude the idea that their work can and must be measured and its value approximated Therefore, no man should adopt the attitude that they can't be measured. Some people think that advertising can't be measured. This is not because it can't be measured—it is because their education, their experience has not progressed far enough to give them the ability to measure it. The savage seeing the lightning in the sky would probably find it possible to imagine that the electric fluid could never be measured, but it is being measured. The main purpose of any cost-keeping system is to find measures for many things that can be measured by the ordinary bookkeeping processes, or by the mere senses of careful foremen, and thereby arrive at standards of production for guidance in forming policies. If a cost system be a reflection of a man's mind, or of the minds of a number of men, it becomes very important to find out what kind of men they are.

Types of Men—The Strenuous.

There are three fundamental types of men in the world. There is the strenuous type, the systematic type, and the efficient type. These fall into divisions, determined by the methods they use and all of their mental and physical equipment. All these types are reflected in cost keeping systems. The strenuous man, for instance, is the hard working type. He may be called the sweat type. His philosophy in life is embodied in "do it now." He is a doer worker of muscular type. We have had thousands of them in our factories as managers. They are busy—busy-ness is business with them. They are the men who get down to the office at six o'clock in the morning and work until ten o'clock at night. They never think of the factory hygiene, of lighting, of plant planning, of functionalizing, of standards, of education. Their ideal is hard work. They take literally the proposition that man must gain his livelihood by the sweat of his brow. When everybody worked that way, of course, strenuously was the order of the day. It didn't make any difference—the world was on a sweat basis. Then the man who was the most strenuous made the most money in feeding a hungry market. It was a brute force—physical stamina that won. One unskilled laborer was as good as any other unskilled laborer; but when skill came into competition with the man at the bench; when brains, forethought, planning and thinking came into competition with the strenuous manager, then came the demand for protection, and the outcry against competition.

Gospel of the Strenuous.

The purely strenuous type can be seen in a bookkeeper who works hard, who is loyal, who fusses and fiddles over things; but the rule-of-thumb or strenuous man is the type that believes if he lowers his cost each month or each year, he has gained highest efficiency. He maintains that his business is different from any other business. He thinks the only thing worth taking from anybody else is to steal a patent, or to steal a man who has shown that he can do more than anybody else.

The rule-of-thumb man says "each man is different," that "you can't teach salesmen," that this man who is doing things so successfully has an unusual faculty possessed by nobody else. His apprentices learn by doing (the good and the bad things); he hasn't any school of workmen (they already know). A school for teaching salesmanship would make him laugh—and yet he is buying his cash registers, his adding machines, his insurance policies and his loose-leaf devices, if he has any, from salesmen who have been taught in schools how to sell the produce to just such a man as he.

The rule-of-thumb man never joins business organizations except to be a good fellow—he never makes a research to find out new things—he calls it high brow theory. You can't tell the rule-of-thumb man anything, because you can't tell any man anything that he doesn't know. The rule-of-thumb farmer plants by the almanac and reaps by the grace of God. The rule-of-thumb mechanic has learned his good and bad methods by the side of an older mechanic, who learned his good and bad methods from another. Each loses a certain amount of efficiency in the process of learning. He doesn't study trigonometry or geometry. He doesn't care anything about such high-brow stuff, but he is a loyal member of his organization and talks against capitalists who don't do anything.

The rule-of-thum employer cares nothing for co-operation. He sees nothing but competition. The only kind of organization he wants to belong to is an anti-union organization. He is an anti-laborer; he believes that you have to use the big stick, that you have to drive men instead of lead them, because—well, you see, that's the way it always has been done, and my father did it that way.

The rule-of-thumb banker, the rule-of-thumb retailer—all of them have ingrowing businesses, because their education has never gone beyond the confines of their own particular experience. They can imitate, but they can't adapt. They don't really think about their business—they only think about the dollars and cents. They don't think about men, but they think about machines. Their costs are necessarily nothing but approximations, more or less distant, of an ideal set by the men who have worked under different conditions of a more or less distant past. In such a plant you see do-it-now signs all over the place. In such places salaries are raised by the time clock and calendar. Such a manager has no methods of measuring men's

*Advertising Manager, Burroughs Adding Machine Co., Detroit, Mich.

efficiencies because he doesn't know what those efficiencies are.

His ideal of a cost system is a crude method by which the pieceworkers can be prevented from getting more than he thinks they are worth. He says no laborer is worth more than $2 a day because that's all he has ever paid, and he is perfectly satisfied if a salesman increases his business 10 per cent. a year in his territory. If his competitor lowers prices, he wonders where his competitors steal the raw material and how long he can continue to lose money. It never occurred to him that a man can beat him at his own game and make a fortune in the process.

He doesn't analyze his business and its possibilities to find out the real reason for his success or failure. He hasn't time. He is too busy doing things. In the hiring of people, his ideal is to try them out—see what they can do. The try-and-fail method is a gospel to him. He solemnly asserts that you can't tell what any man is able to do. That other concerns are foretelling and finding out what types of men are necessary for certain jobs, are pre-determining what men will fit the jobs and then getting the men to fit the jobs, is a joke to him.

Of course, you can't tell him anything about it, because he doesn't know anything about it. He doesn't know anything about the idea because he has never seen it at work. If he did see it, he would probably dismiss it with—the employment manager was better than usual, but as for finding law or principle in any course of action, he dismisses it with—it is the man who is doing the work, and the man who is getting the results.

The rule-of-thumb manager prides himself upon knowing his business. He never thinks of using outside counsel. If a man would suggest to this type of mind that there is a better way in which to grind a valve, his first question would be—how many valves have you ground? In other words, his attitude of mind is of the man looking in the mirror when he is looking for all the reason for success. It is a type of mind of which we have had entirely too many, and which competition and the efficiency of skilled minds, applied to skilled work, is gradually forcing out of business. These rule-of-thumb managers act as the priests of old, adopting a precedent as a sacred flame which has passed from hand to hand, from generation to generation, each keeping it inviolate, never changing it, until it becomes a sacred tradition before which youth and skill and brains and power must bow in submission. The rule-of-thumb manager is always a liability and never an asset. He may be popular, he may have succeeded, he may be succeeding, but, just as inevitably as the sun rises, his day is done.

Concerning the Bolting-Up of Wood Framework

By W. J. Horner

The particular feature dealt with in this article is the insertion of bolts in the ends of wood rails, the latter being connecting pieces between a pair of cast iron standards, the whole constituting types of machines for winding, beaming, etc., in the manufacture of textile fabrics.

FOR several years the writer was employed in a shop where machines were built for winding and beaming and various other operations in connection with the making of textile fabrics. This was in the Kensington district of Philadelphia, Pa., U.S.A., where a large amount of textile work is done. When there was no pattern work to be done I used to assist in the general woodwork of the shop, and, as the same kinds of work were being constantly repeated, it was all done on a system evolved by long experience. The particular feature dealt with in this article is the insertion of bolts in the ends of wood rails. A large proportion of the machines built consisted primarily of a pair of cast iron standards or end frames connected by four or more wood rails of ash or maple, the length of these rails depending on the character and size of the machine. Machines for some purposes were entirely of wood framework bolted together.

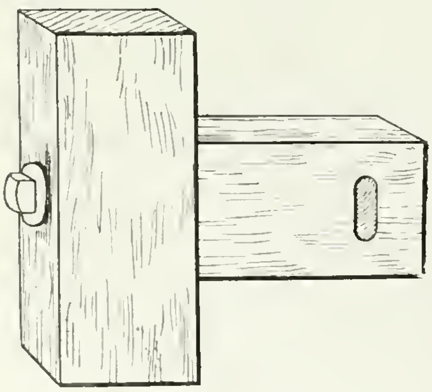

FIG. 1. BOLT WITH ITS NUT INSERTED IN THE WOOD.

The bolting was done, as shown in Fig. 1, by inserting the nuts in holes cut in the wood, these holes being plugged after the nuts were in. In a case like Fig. 1, where wood is bolted to wood, the joint would be tenoned to prevent twisting and keep the faces flush, but in fitting wood to metal the joint was a plain one.

Fig. 2 shows a side and edge view of the end of a tenoned member with bolt

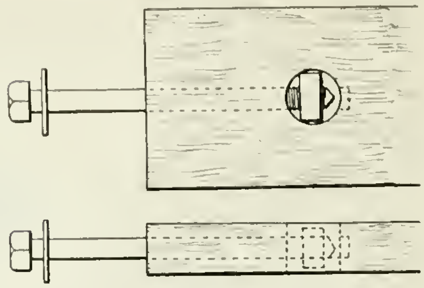

FIG. 2. SIDE AND EDGE VIEW OF RAIL END WITH BOLT INSERTED.

inserted. The other member would be mortized to fit the tenon. The bolts used have square heads, pointed ends and rectangular nuts longer in one direction than in the other. The pointed ends enable the bolt to find its way into the nut easily. Large washers are used at the heads, but none at the nut ends. The insertion of a bolt in this way looks difficult and complicated, but a man accustomed to the work can do it in a few minutes, and it makes a strong and neat union.

First, the distance from the end of the

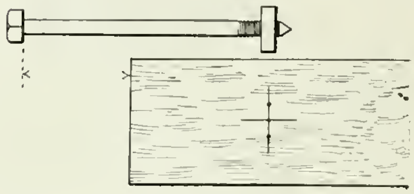

FIG. 3. FIXING DISTANCE FROM END OF RAIL TO NUT.

rail to the recess for the nut is marked. A bolt long enough to avoid risk of tearing out is selected and laid on the rail, while the distance between the end of the latter and head of the bolt is measured. This distance is indicated by ticks in Fig. 3, and corresponds with the thickness of the piece to be bolted to the end of the rail. In the case of an iron standard it might not be more than ⅝ in., but for a wood post the bolt would have to stand much farther out, and, of course, its total length should be more. It is sufficient to mark the centre

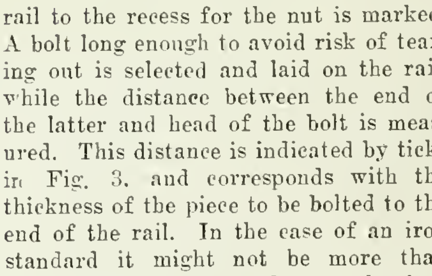

FIG. 4. HOLES BORED FOR NUT RECESS.

line of the recess, as in Fig. 3, and a centre line at right angles to this is gauged across it. The best surface of the rail is selected for the front or up-

per face, and the nut inserted from behind or below.

Another thing to consider is camber or curvature, which nearly always exists in long rails. The convex side should be upwards so that subsequent sagging by its own weight will correct it and make possible development of curvature in the opposite direction less pronounced. These things decided, the nut hole is indicated by two crossing centre lines, as in Fig. 3, and is bored with a centre bit to the correct depth, three holes being bored, as in Fig. 4. The sides of the bored recess are then cut straight with a chisel and the ends left semi-circular, extending beyond the length of the nut.

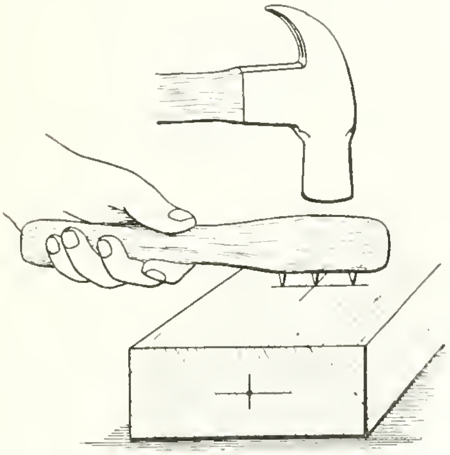

FIG. 5. MARKING CENTERS FOR BORING

The reason for semi-circular ends is partly to save the trouble of cutting square, and partly because a hole with square ends would have to be cut a trifle longer than the nut, and one or both ends plugged to adjust the nut. Semi-circular ends allow a little adjustment, and are as easy to plug as square ones.

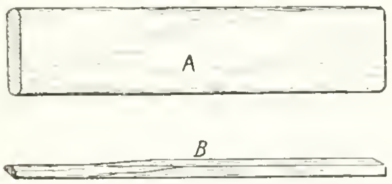

FIG. 6. STRIPS FOR PLUGGING

The sides of the nut recess are chiseled before the bolt hole which runs into it at right angles is bored. The boring for the recess was done under a drill press adjusted for the exact depth—that is, to the centre of the wood, plus half the thickness of the nut. The bolt holes were bored on a horizontal boring machine. This boring could be done by hand, but would be comparatively slow and hard work, especially in hard wood and when a large number of pieces are being dealt with. Of course, there are cases where bolts are required out of centre, and then the nuts would be put in from the nearest side. In very heavy rails two bolts were used at each end.

The bolt centres are gauged on the end of the wood and centre punched. Fig. 5

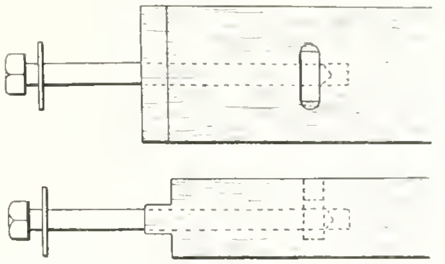

FIG. 7. NUT INSERTED IN ROUND HOLE.

shows this and also an appliance for marking the three centre-bit holes simultaneously at correct centres to suit the nut. This appliance was simply a piece of hard wood with three steel points inserted, and it was set with its centre point on the intersection of the lines, as in Fig. 5, and given a light tap with a hammer to mark the centres.

Before plugging, it is necessary to see that the bolt enters the nut easily. Bolt holes frequently run more or less out of centre, and the nuts have to be adjusted to suit. If the hole comes slightly too low or too high in the nut recess it often means deepening the latter or putting a bit of chip or cardboard in the bottom to keep the nut high enough. With the bolt in the nut, a strip of wood, B in Fig. 6, is pared with a chisel to go into the semi-

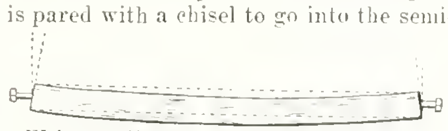

FIG. 8. CURVED RAIL WITH ENDS BEVELLED SO THAT BOLTS WILL PULL IT STRAIGHT.

circular spaces beyond the ends of the nut and a portion of it snapped off in each level with the top of the nut. The hole above the nut is next plugged with a piece planed to the shape, as at A in Fig. 6. This gives an end grain plug, which is conspicuous, but it has the advantage of being planed in a strip, from which a number of plugs can be cut, and also is easier to extract if the nut has to be taken out. This plug is driven in tight with glue and sawn off and trimmed level. It is best to have the nut the least bit slack in every direction, and the plugging is done with the bolt in the

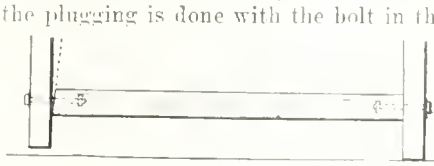

FIG. 9. RAIL END BEVELLED TO LOWER ONE LEG OR RAISE THE OTHER

nut. Bolt holes should be about 1/16 in. larger in diameter than bolts, and the latter must enter the nuts without binding against the side of the hole, otherwise it is difficult or impossible to get them into the nuts at all in bolting up the structure.

A quicker way of inserting a bolt in a thin rail is shown in Fig. 7. Centre lines are marked as before, but instead of boring three holes for an oblong recess, a single hole just large enough to take the nut is bored right through and not plugged. This, of course, looks rough, but is quite effective. It was done only in a certain class of work where the pieces which received the nuts were wide and thin.

In marking out a number of pieces for bolts, gauges are set for marking the centre lines on face and ends, and direct measurement from the bolt itself, as in Fig. 4 is only done in the first instance, the distance being gauged if a number of pieces have to be done together.

Two rather remarkable features in this kind of work are that the pull of the bolts is utilized sometimes to straighten or give a slight upward camber to a long horizontal rail, and sometimes to vary the height of the feet when a first trial shows that the structure rocks instead of bearing evenly on the floor. This latter only applies to short structures, as rails of great length have sufficient flexibility to adjust the feet of the end frames to the floor. Both of these things depend on the way the ends of the rails are cut. They are cut square at first, but this may have to be modified to meet either of the conditions just mentioned.

Fig. 8 shows how a curved rail is treated to pull it straight. A few shavings are planed off to give the ends a slight bevel, as indicated by the dotted lines; then when these ends are pulled up tight by the bolts against unyielding end frames, the effect is to set up a strain throughout the length of the rail which forces the rounding side in and the hollow one out and straightens the rail if the correct bevel is given to the ends. A straight rail can be cambered on the same principle. Often a rail is straight in a portion of its length and curved in another, and this usually means that the curve must be taken out by treatment at one end only.

Fig. 9 shows how the raising or lowering of a leg or foot is accomplished. The leg at the left-hand end is off the ground, but would be brought down by cutting the end of the rail, as shown, and tightening the bolt until the end came in contact at the place shown slightly open. This would also have the effect of slightly cambering the rail at that end, and sometimes it might be advisable to treat the other end instead, cutting it the opposite way, which would give the same result; or both ends might be treated, half the amount of bevel being removed from one, and the other half the opposite way from the other. The fitting of wood rails between cast iron end frames is complicated also by the fact that the metal surface is seldom true.

Grinding Wheel and Grinding Machine Safeguards

Being the report of the committee appointed by the National Machine Tool Builders' Association to consider grinding wheel and grinding machine safeguards and matters relating thereto. The cuts accompanying this article are from photographs furnished by the Norton Co., Worcester, Mass.

ALL wheel manufacturers, to the best of our belief, subject grinding wheels to a speed test. This speed test consists of revolving the wheels at higher speeds than they are recommended to operate. Your committee sees no reason for changing present recommended operating speeds and suggests that approval be placed on the practice of wheel manufacturers in subjecting wheels to a speed test. The recommended operating speeds should not be exceeded by the user, with the possible exception that cylinder wheels, when used in a chuck which incloses at least three-quarters of the wheel, can be operated at speeds recommended for straight wheels.

Control of grinding machine speeds so far as related to speed of grinding spindle.—Where cone pulleys are in use, belt-locking devices or some other device to prevent the belt from slipping to a smaller pulley should be used. If a wheel spindle be driven by a variable speed motor, speed control of the motor should be inclosed in a locked case or some device should be used which prevents motor from being run at too high speeds.

Mounting of Wheels.

Size of Flanges.—On floor and bench machines, straight flanges should be at least one-half the diameter of the wheels. Safety flanges (sometimes referred to as tapered, bevelled or protection flanges) should be of such size that not more than 1/4 in. of the wheel projects beyond the area of the flanges. Designers of cylindrical, universal, internal and wet tool grinding machines have found it advisable to make use of flanges smaller than half the diameter of the wheel. On the types of machines mentioned, a well-designed, substantial protection hood should always be used unless the nature of the operation absolutely prevents its use.

Washers.—Washers of some compressible material which are slightly larger than the flanges, should be used between the wheel and the flanges. Such washers tend to distribute the pressure uniformly when the flanges are tightened against the wheel. Compressible washers of blotting paper or rubber gaskets are satisfactory.

Relation between size of wheel and size of machine.—Caution must be taken not to use wheels larger or thicker than recommended or provided for by the grinding machine manufacturer. If it be desired to use larger or thicker wheels, the matter should be taken up with the machine manufacturer.

Relation between size of hole in the wheel and size of arbor or spindle.—The hole in the wheel and the spindle on which the wheel is used should be of such diameter that the wheel slides on the spindle easily, yet not loose enough to in any way cause the wheel to run out of true. If the hole of the wheel be small it can easily be scraped out if leaded; or worked out with an old file if not leaded. Such work, however, should only be done by careful workmen, since breakages are known to have resulted from improper reaming of holes. Insofar as possible, your committee recommends that, for future designs of floor and bench machines, you adopt uniform sizes for grinding wheel spindles in accordance with the table here given.

SIZES OF SPINDLES RECOMMENDED AS STANDARD FOR VARIOUS DIAMETERS AND THICKNESSES OF GRINDING WHEELS. NATIONAL MACHINE TOOL BUILDERS' COMMITTEE — APRIL 23-24, 1914.

THICKNESS OF WHEEL IN INCHES.

Diam. in inches	1/4"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"	2 1/2"	2 3/4"	3"	3 1/4"	3 1/2"	4"	4 1/2"	5"
6	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	1	1	1
7	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	1	1	1	1	1	1
8	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	1	1	1	1	1	1	1	1 1/4	1 1/4	1 1/4
9	3/4	3/4	3/4	3/4	3/4	3/4	3/4	1	1	1	1	1	1	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4
10	3/4	3/4	3/4	3/4	3/4	3/4	3/4	1	1	1	1	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2
12	3/4	3/4	3/4	3/4	3/4	1	1	1	1	1	1	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2
14	7/8	7/8	7/8	7/8	1	1	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2
16					1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 3/4	1 3/4	1 3/4	1 3/4
18					1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 3/4	1 3/4	1 3/4	1 3/4	1 7/8	1 7/8
20						1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 3/4	1 3/4	1 3/4	1 3/4	1 7/8	1 7/8	1 7/8	1 7/8
24						1 1/2	1 1/2	1 1/2	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4	2	2	2	2	2	2
26							1 1/2	1 1/2	1 3/4	1 3/4	1 3/4	1 3/4	2	2	2	2	2 1/4	2 1/4	2 1/4
30								1 3/4	1 3/4	2	2	2	2	2 1/4	2 1/4	2 1/4	2 1/2	2 1/2	2 1/2
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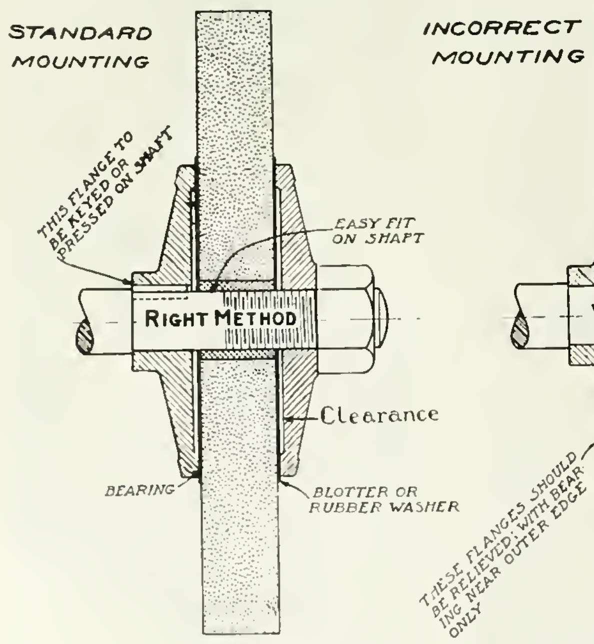


THE MOUNTING OF GRINDING WHEELS.

Relief of Flanges.—All flanges, either straight or safety shape, which are used on floor and bench machines, should be relieved. Flanges used on all other types of machines should be relieved wherever possible The extent of the relief should be such that a flat ring-bearing surface, which is approximately 1-16 of the diameter of the flanges in width, is left near the periphery of the flanges.

Cup and Cylinder Wheels.—The types of wheel chucks which inclose at least 3/4 of the wheel have proven satisfactory, so that if a cylinder wheel be used in such a chuck the mounting can be considered satisfactory. When cup wheels are mounted between flanges, both flanges should be of the same diameter and should be of such size that the inside flange has not less than 1/4 in., or more than 3/8 in. clearance between its periphery and the inside surface of the rim of the wheel. All cup wheels mounted

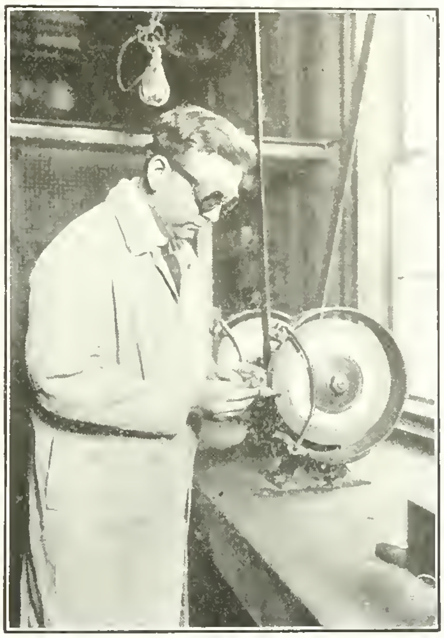
between flanges should be covered, as much as operating conditions will allow, with a protection hood. Cup and cylinder wheels which are mounted in a manner similar to those used on the Pratt & Whitney vertical surface machine should always be protected by a strong hood.

Clamp centers.—Care should be exercised in mounting wheels with clamp centers. If the hole in the wheel and the part of the center which goes into the hole is a tight fit, there is great danger of the wheel being broken when the bolts are tightened. If a wheel does not mount easily on clamp centers, the manufacturer of the wheel should be notified and the wheel put to one side until receiving his instructions.

Devices to Protect Operators.

Wherever the operation will permit, a well-designed, substantial protection-hood should be used. In such situations, a tapered wheel and flanges of a corresponding taper are not necessary. Where hoods cannot be used, tapered wheels in connection with flanges of a corresponding taper afford the next best means of providing safety. Care should be taken not to use flanges tapered less than the wheel is tapered. Tapered flanges should be of such diameter that as little as practical of the wheel should be allowed to project. In no case should the portion of the wheel extending beyond safety flanges be more than 4 inches.

The present type of hoods used on cylindrical machines, plain surface grinders, universal tool and drill grinders, are proving satisfactory; but if



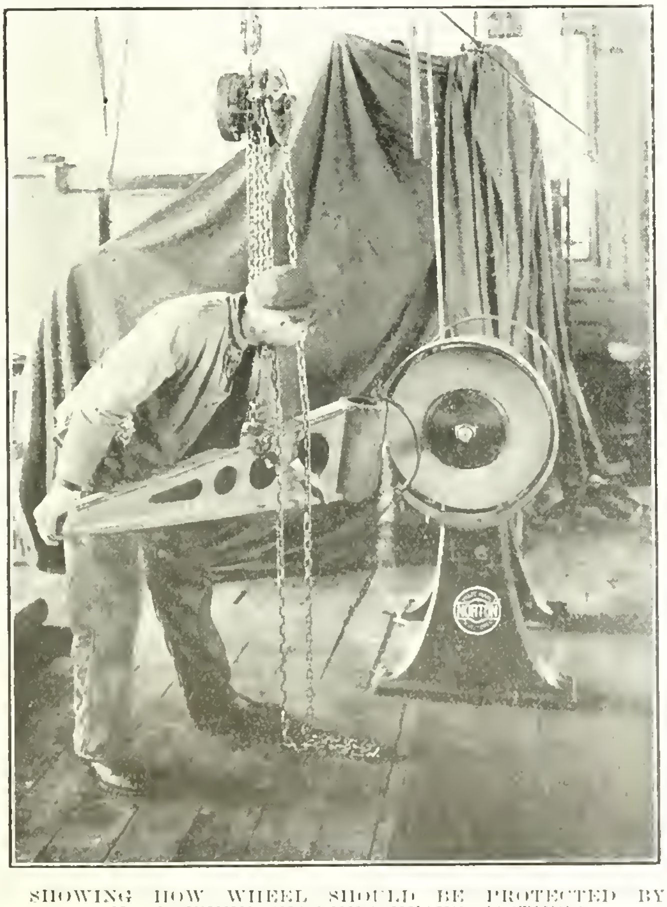
BENCH TYPE GRINDING WHEEL STAND PROPERLY EQUIPPED WITH PROTECTION HOODS. NOTE GOGGLES ON OPERATOR.

larger and thicker wheels should be used some of the types of hoods now in use may prove to be unsatisfactory. If failure of a hood should occur under any conditions whatsoever, this committee will be very grateful for complete details regarding the case in question.

The statement is sometimes made that it has been found impracticable to use hoods or guards for a number of common grinding operations. It is the concensus of opinion of your committee that if a little time and care were spent on the design of a hood one could be installed which would provide the necessary amount of safety and yet not interfere with the operation in question.

General Suggestions.

It is good practice to have one man assigned to the care of grinding wheels and machines. He should examine every wheel before it is mounted, supervise the mounting of the wheel, and be held responsible for proper speeds being used. Care should be exercised in the storing of grinding wheels, making sure that the wheels are not damaged in any way. Wheels used for wet grinding should not be left partly submerged in water over night or else when starting in the morning the wheel will be found to be badly out of balance. If the grinding wheel vibrates badly it should be carefully trued. If vibration is found to be present after a wheel is trued, the wheel should be tested for balance and if found to be badly out of balance the fact should be reported to the wheel manufacturer. On floor and bench machines the work rest should be adjusted close to the grinding wheel to prevent small pieces



SHOWING HOW WHEEL SHOULD BE PROTECTED BY HOOD WHEN SNAGGING HEAVY CASTINGS WITH AID OF CHAIN HOIST.

SHOWING PROTECTION HOOD, LEATHER SPARK BRUSH, GLOVES, GOGGLES AND PROPER ADJUSTMENT OF REST

from wedging and thus causing accident.

Grinding Machines.

Belts.—All belts within reach of the workmen should as far as possible be guarded on the intake side.

Revolving set screws, dogs, etc.—The design of machines should be such as to avoid as far as possible the use of set-screws and dogs. Where it is not possible to eliminate them, countersunk set-screws and properly guarded dogs should be used.

Gearing.—All gearing should be fully guarded.

Chances for being pinched.—This should be taken care of in the design of the machine.

Means for avoiding cuts from grinding machines.—It is often possible to make use of swinging pans of guards which will come between the operator's hand and the grinding wheel, thus greatly reducing the chances of being cut by the wheel.

Dust Exhaust.

Existing State laws are stringent enough to take care of any quantity of dust generated by dry grinding or polishing. Positive means for disposing of the dust after it is collected should be provided.

Laws.—Federal, State and Foreign.

It is recommended that this Association uses its influence towards a uniformity in laws and that support be given to the Brommer Bill which is now before the U. S. Congress.

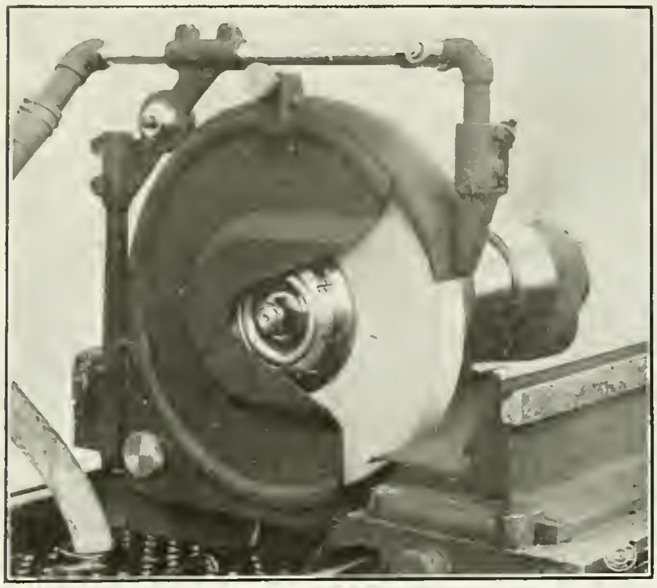
Relation to Accident Insurance Companies.

This Association should work toward a reduction in the rates of accident insurance by providing adequate guards to machine tools. It is recommended that the compensation laws be so interpreted and administered as to maintain a good understanding between employer and workmen.

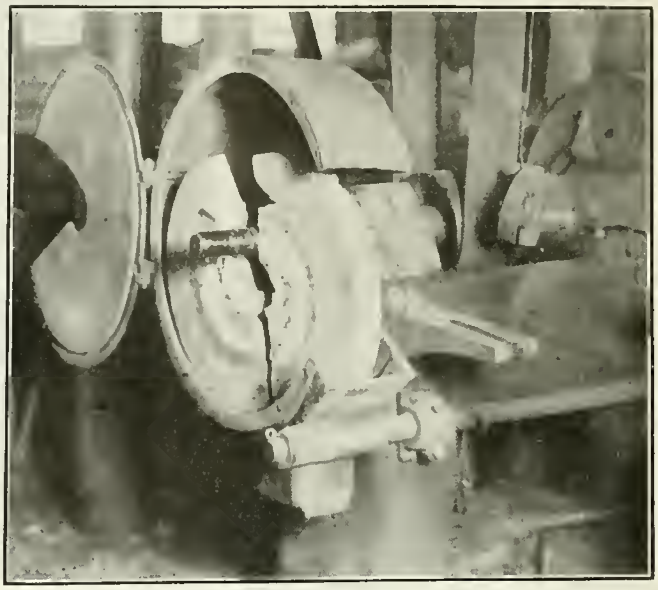
Relation to Other Societies.

It is the recommendation of your Committee that hearty support be given to other national societies in their safety work

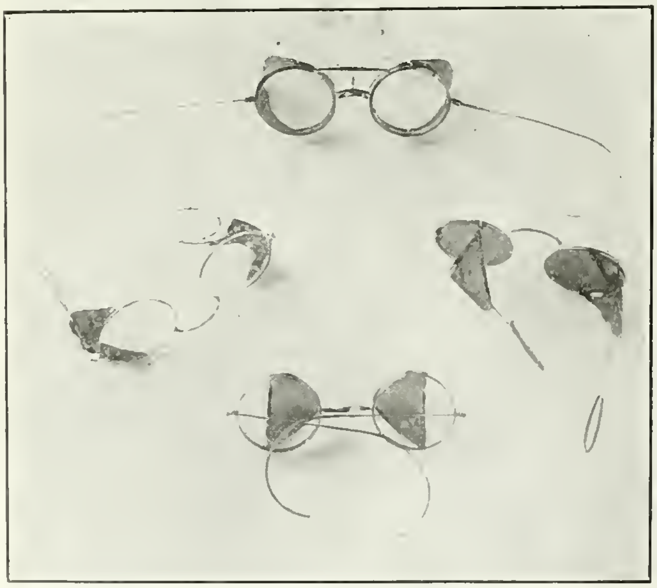
We understand that a central safety committee has been formed by some of



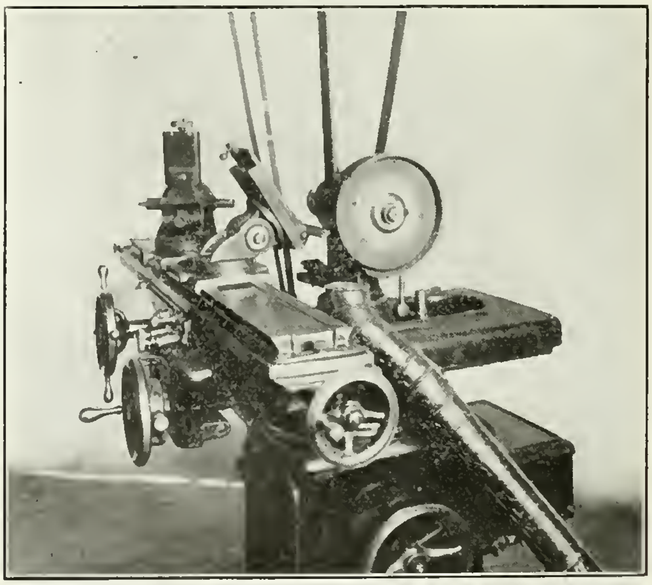
HOOD ON NORTON CYLINDRICAL GRINDING MACHINE.



EFFICIENT TYPE OF HOOD FOR FLOOR STAND.



TYPES OF GOGGLES USED BY GRINDING WHEEL OPERATORS.



CAST STEEL PROTECTION HOOD ADAPTED TO TOOL AND CUTTER GRINDING MACHINE. HOOD IS ADJUSTABLE.

the other national societies among whom are the National Association of Manufacturers, and the National Founders' Association The plan is to eliminate duplication of effort as much as possible, besides obtaining the views of all parties directly interested. For instance, to the National Founders' Association would be assigned the task of specifying safeguards for foundry machines, and this phase of the safety question would therefore not be touched upon by the other associations.

We feel that the Machine Tool Builders' Association should be the one to handle the subject of safeguards for machine tools, and therefore suggest that the secretary be asked to correspond with the central safety committee regarding this matter.

ELECTRO-PLATING ZINC ALLOY DIE CASTINGS.

DIE castings that are to have a polished surface should be "cut down" with the usual buff wheels and tripoli composition, says a booklet issued by the National Lead Co., New York. The finishing should be done with white compositions of Vienna lime. After the parts have been polished, the excess of polishing material should be removed by the aid of benzine or gasoline, and they should be dried in maple sawdust. If the benzine or gasoline is dispensed with, hot alkaline solutions should be used for cleansing. The strong alkalies of caustic soda or potassium should never be used in cleansing zinc, as they have a reducing action upon the metal and produce oxides, thus destroying the polished surface. The solution should be maintained at a temperature of 160 to 180 degrees F. Soda ash may also be used for the purpose, one pound of this material and one-quarter ounce of cyanide of potassium being used per gallon of water.

The articles should remain in the cleansing bath for a few minutes, and then the excess polishing material brushed away, using painters' oval sash brush for the purpose; the rubber-set variety is the most economical. After cleansing, immerse in clean, cold water, and then into a cyanide dip. This dip should consist of 6 ounces of cyanide of potassium or sodium to each gallon of water, and should be used cold. After re-washing the articles in clean cold water they are ready for the plating bath.

Articles to be finished are cleansed in the same manner, if somewhat corroded due to the formation of oxide of zinc on the surface by contact with moisture. Immerse for a few seconds in a pickle consisting of one part of hydrochloric acid and four parts of water (this will dissolve the oxide); then rinse the die castings in cold water, immerse in the cleaning solution for a few seconds, rewash in cold water and scratch-brush to bring up the color of the metal. Repeat the cleaning operations, using only the cleaning solution and the cyanide dip; the casting is now ready for plating. If the articles are to have a polished finish, the scratch-brushing may be dispensed with.

Copper-plating Die Castings.

The solution for copper-plating should have the following proportions:—

Water	1 gallon.
Cyanide of copper	3 ounces.
Carbonate of potash	1 ounce.
Cyanide of potassium or sodium	4 ounces.

To prepare the solution, the potash and copper should be dissolved in half the amount of hot water, the cyanide in the balance of lukewarm water; then mix thoroughly together. Use the solution at a temperature of 150 degrees F. and at 2 to 2½ volts pressure. Cast copper anodes give the best results, but the electrolytic variety may be used.

Brass-plating Die Castings.

Prepare a solution exactly the same as for the copper bath; then dissolve equal parts of cyanide of zinc and cyanide of potassium in warm water. An addition of 1 ounce of zinc carbonate and the same proportions of cyanide should be added to the copper bath per gallon; then add ½ ounce of sal ammoniac per gallon of solution. If the color should be too deep a yellow, a little more zinc should be added to the bath to obtain the required shade. This bath should be used at a temperature of 120 degrees F. and at 2 to 3 volts pressure. The cleansing of the articles should be done as previously stated.

Nickel-plating Die Castings.

Much trouble has been experienced in nickel-plating die castings with the ordinary solution, due to black streaks appearing in the deposit caused by local action of the ordinary solution upon the metal. The following formulae will give satisfactory results without the difficulties mentioned:

Nickel sulphate	10½ ounces.
Potassium citrate	7 ounces.
Ammonium chloride	10½ ounces.
Water	2½ gallons.

To prepare this bath, dissolve the nickel sulphate and ammonium chloride in half the amount of hot water prescribed; then dissolve the potassium citrate in the balance of the water and mix thoroughly. The voltage should be 2½ to 3 volts. This bath should always be kept neutral to avoid black streaks. For this purpose, pure caustic potash dissolved in water should be added to the bath so that the solution is neutral to the test of red or blue litmus paper.

The following bath is used extensively in plating articles made from zinc and gives excellent results:

Double nickel salts	8 ounces.
Chloride of sodium	1 ounce.
Magnesium sulphate	2 to 4 ounces.
Water	1 gallon.

To prepare the bath, dissolve the nickel salts in half of the water at a temperature of 180 degrees, and dissolve the other salts in the balance of cold water; then mix thoroughly together. Use this solution cold, with anodes of cast nickel. The voltage should be 2½ to 3½ volts. The articles to be nickel-plated may be plated direct or be lightly coated in the copper or brass baths prior to nickel-plating. The time of immersion in either of the nickel baths should be according to the thickness of the deposit required, although thirty minutes gives a fairly good deposit in either case.

Silver-plating Die Castings.

Cyanide of silver	3 ounces.
Cyanide of potassium	4 ounces.
Water	1 gallon.

Use anodes of pure silver at about 1 volt pressure. Die castings for silver-plating should be previously copper-plated for a short time, then amalgamated in a mercury dip consisting of the following proportions:

Water	1 gallon.
Oxide of mercury	½ ounce.
Cyanide of potassium	6 ounces.

After copper-plating and washing in water, the articles are immersed in the dip for a second or two, or until uniformly coated with mercury. They should then be re-washed and immersed in the silver bath. The articles may also be nickel-plated in one or the other of the nickel baths, and then quickly coated in the silver striking solution, after which they should be directly immersed in the silver bath without rinsing.

The silver strike should be as follows:

Cyanide of silver	½ ounce.
Cyanide of potassium	6 ounces.
Water	1 gallon.

Use silver anodes with 3 to 4 volts pressure. The nickel surface must be immediately coated over for successful silver deposits.

U.S. Anthracite Coal Production.—All previous records of anthracite coal production were broken in 1913 when the output was 81,718,680 long tons, according to recent figures by the Geological Survey. This exceeded the highest previous output by nearly 1,000,000 tons. Last year's production was valued at $195,181,127, compared with 75,322,855 tons valued at $177,622,626 for 1912. The average working time for men established a record in the anthracite region. The average was 257 days, the nearest approach being in 1911, when an average of 246 working days was recorded.

Some Recent Improvements in Case-Hardening Practice*

By H. L. Heathcote, B.Sc.

The subject matter of this article treats of what has been done relative to case-hardening in the works of the Rudge-Whitworth Co., Coventry, England, and indicates at the same time how the problem presents itself and the manner of seeking a solution.

EVEN to the casual visitor and the superficial observer it must be obvious that, generally speaking, the machine shop is ages in advance of the hardening shop. In the machine shop are to be found highly differentiated machine tools, each the last word in scientific design and construction, embodying the best engineering knowledge and skill of many nations. The tools, as often as not of high-speed steel, and the grinding wheels, are both the outcome of special research in different branches of chemical industry. The men are well trained and well paid, and the organization of the shop is another testimony of the stage of development arrived at. Not only are its tools, its plant, and its employees of superior grade, but its output is subjected to strict viewing by skilled men using instruments of precision. Needless to say this reacts on the shop as a whole, and makes for rapid rectification of faults and a high standard in every part.

Compare this state of affairs with that prevailing in a typical hardening shop some years ago. Instead of a well-lit, well-ventilated, and comparatively clean shop, we find a dark, grimy shed, something like a miniature gasworks, unbearably hot and reeking with cremated ox remains and fishy oil. Here a gang of men pound a dusty black mixture into iron pots round some of the articles that have just come from the machine shop or automatic shop; there another gang, equally grimy, but more oily, wield tools that Tubal Cain may have used—their plant, crude furnaces, uncontrolled save by the unaided eye.

Not only were their tools and plant crude; their materials and labor were crude too. The labor employed was anything but skilled, and the case-hardening composition savored more of quack medicines than British pharmacopoeia preparations. What little viewing was done threw little or no light on the causes of distortion, softness, or cracks, yet this was the shop to whose tender mercies much of the machine shop output was handed over, there to be made or marred.

This then was the problem: to raise this outcast, isolated, and forlorn process of chemical industry to the dignity and standing of machine-shop practice; to investigate the materials it employs and throw light on their mode of action; to provide simple means of controlling the furnaces and of measuring the resultant hardness and resistance to shock; in a word, to do for the hardening shop what science and industry had already done for the machine shop.

An Improved Pyrometer.

We started out at the furnace end and decided to install pyrometers, but were soon met by the fact that an efficient pyrometric outfit for a battery of thirteen muffles is an expensive thing, especially for an industry where competition is so keen and the work so varied. Moreover, it threatened to cost something to keep it in working order; and on second thoughts it seemed very questionable whether thermo-electric and resistance pyrometers would be suitable for a system starting with a hot furnace full of cold work, or for ascertaining the temperature of an isolated article.

The Fery instruments were then unknown, so the author started investigations at the Rudge-Whitworth Research Laboratory with the object of ascertaining the temperature of red-hot bodies from their color. On examining the spectrum of a red-hot piece of steel it is found to elongate at both the red and violet ends and to increase in intensity all along as the temperature rises. This suggested the possibility of ascertaining the temperature of red-hot bodies by means of a direct vision spectroscope provided with a graduated scale (also used by Hempel), but it soon became evident that the difficulty of seeing just where the green ended precluded the possibility of anything approaching accuracy; and the extension of the red end was not sufficient for the purpose. Attempts were made, by screening off the brighter parts of the spectrum, to render the green or blue end more distinct, but it was found that the end point varied considerably with the same observer, and that many eyes cannot focus a sharp image on the retina when pure blue or green rays are transmitted. A long series of experiments was carried out to try and produce solutions and mixtures of solutions or emulsions, the absorption of which closely followed, both in range and intensity, the radiation curves for steel at different temperatures.

Permanence of Selected Solutions

Having found a range of solutions capable of absorbing the rays emitted by red-hot steel at various temperatures, and at the same time suited to the peculiarities and conditions of the eye, the author proceeded to investigate the permanence of the various mixtures in the dark and under the action of light; also their behaviour in contact with retaining vessels, such as glass and india-rubber. Some were found to decompose on keeping, some changed in color, some precipitated; others were found to be soluble in glass. Some were found to withstand the action of light, in contact with glass and india-rubber, without any apparent change.

Calibration of Solutions.

The chosen solutions were calibrated by viewing the end of a steel cylinder heated in an electric furnace and taking the temperature of the steel at the moment is ceased to appear visibly red by means of a platinum-rhodium thermo-couple pushed close up to the back of the cylinder end. To remove any possible error due to the temperature of the junction being perhaps not exactly the same as that of the visible end of the cylinder, the calibration of the couple was effected by melting a number of pure substances of known melting-point on a minute ledge on the flat end. For temperatures above the scope of this arrangement the thermo-couple was dispensed with, and the melting of, for instance, nickel and platinum observed through the cells.

Design of Instrument.

In one of its forms the instrument has a stereoscope-like eye-shield to guard the eyes from extraneous light. Instead of two lenses there are two pairs of dye solutions well protected by caps, which also serve to keep the light out. This form is suitable when some particular temperature is required. For instance, the case-hardening temperature is now controlled by employing an instrument like this, with one pair of cells containing dye solution adjusted to 900° C. and the other to 925° C. If the pots are visible through the 900° pair and invisible through the 925° pair the temperature is considered correct. There is no need to remove the eyes while the pairs are changed; this is done by sliding the aluminium carrier to one side or the other.

For re-heating work, and for hardening tools, a single pair is all that is necessary. The hardening temperature is attained as soon as the work appears just visibly red. For double re-heating, two pairs are, of course, necessary; e.g., 760° and 880° C. The cells can be interchanged and are readily detachable, so

*From a paper read before the Iron and Steel Institute.

that one instrument can be used to ascertain any temperature, provided the object be visibly red hot. The actual container is a glass tube less than 1 inch long, with accurately fitting glass ends held together on rubber rings by two telescoping brass tubes. In form the cell is much like a short polarimeter tube. The caps on the aluminium slides are provided with springs to prevent the cells falling out.

In another form the instrument is adjustable, and is either monocular or binocular. In these, the dye solution is contained in expansible cells, and a range of absorptive powers obtained by altering the length of the column looked through. The first of this form was made with two thick glass ends and a length of inner tube from a bicycle tire. On squeezing the glass ends together the rubber sides bulge outwards. The actual container is inclosed in this tube, which is provided at one end with an eye-piece shaped to fit the eye and nose, and at the other with a screw end which lengthens the cell until the added part is sufficient to just absorb the light. The temperature is then given by the scale engraved on the tube, much like a micrometer is read. In this form the instrument is 3 inches long by $1\frac{1}{2}$ inch diameter, and is very handy.

Determining Temperatures.

This method of determining temperatures is a zero method, and is, therefore, caeteris paribus, more accurate than one involving a comparison of colors. Furthermore, the critical point occurs when the eye is shaded from extraneous light, that is when the pupil is dilated and the retina is in its most sensitive condition. In judging temperatures by the unaided eye, errors are caused by:

1.—Extraneous light falling on the eye.

2.—The difficulty of remembering close shades of color.

3.—Errors of judgment in comparing the image of the color observed with a series of mental images of colors previously seen.

All these chances of error are eliminated by an instrument of this kind. No extraneous light falls on the eyes and no recollection is required; the hardener has simply to look through, wait about half a minute until his eyes have become accustomed to the darkness, and then see whether the object is visible as a dark red patch or invisible. Hardeners seem to prefer to use their eyes for telling the temperature, and these instruments provide pyrometric equivalents for limit gauges and screw micrometers, and at the same time screen the eyes from the glare and heat of the furnace.

The readings are admittedly dependent on the sensitiveness of the eye; if this vary from person to person, the temperature readings will vary accordingly, being lower the more sensitive the eye. As already stated, these variations do not affect the accuracy momentously, and from actual experiments carried out with this and with another optical pyrometer working under very similar conditions, the author feels compelled to believe that the variation in sensitiveness, under the actual working conditions of these instruments, is not nearly so great as might be expected. If the object be a large one, it is advisable to interpose a perforated screen between it and the instrument.

One way to make an observation is to adjust the instrument to a lower temperature than that expected, and then, by sliding darker cells into position or by unscrewing (if of the adjustable form), darken the image until it just ceases to appear colored. The temperatures engraved on the cell or the body of the instrument will then indicate the temperature of the hot body, provided that the conditions of the test are as nearly "black body" as those obtaining when the calibration was effected. Fortunately red-hot iron and steel surfaces have an emissivity of nearly unity, so the error is not large, and can generally be neglected for industrial purposes. Furthermore, any error from this source will not prevent the instrument giving comparative readings under similar conditions, which is all that is necessary in repetition work.

These instruments have been applied with satisfactory results to the heat treatment of steel, carburising, re-heating, annealing, and hardening tools of all kinds. One has outlasted two thermo-electric pyrometers, and it is the author's opinion that a pyrometer which indicates its own temperature may convey some idea of the temperature of the work, but will never be the hardener's friend to the same extent as one of the forms of optical pyrometer which can be focused on the article itself.

Case-Hardening Compositions.

Having provided a simple and effective device for ascertaining the temperature of red-hot bodies, the author set about investigating case-hardening compositions, their nature, mode of action, and effect. Obviously, for carburizing to occur, the heat must first penetrate to the steel and raise it to the gamma condition; it must liberate and maintain a supply of the carburizing ingredients; the peripheral layers of the steel must combine with (or dissolve) these ingredients; and the carbide must diffuse from the periphery inwards.

The composition of case-hardening materials varies very widely. The following table shows the range of variation in seventeen commercial compositions tested:

Table I.

	Per Cent.
Moisture	2.68 to 26.17
Oil	0.17 „ 20.76
Carbon (organic)	6.7 „ 54.19
Calcium phosphate	0.32 „ 74.75
Calcium carbonate	1.2 „ 11.57
Barium carbonate	nil „ 42.0
Zinc oxide	nil „ 14.5
Silica	nil „ 8.14
Sulphates (SO_3)	trace „ 3.45
Sodium chloride	nil „ 7.88
Sodium carbonate	nil „ 40.0
Sulphides (S)	nil „ 2.8

When these experiments were commenced the mixture of barium carbonate, 40 per cent., and charcoal, 60 per cent., suggested by Guillet, had not been put forward, and it was usual to use case-hardening compositions once only or perhaps twice. Another drawback experienced in commercial operation, for instance, with pots 10 inches high by 10 inches diameter, was the difference in the depth of penetration near the middle and the outside of the pot. Some compositions showed as much as 150° C. difference in temperature between the inside and the outside. The author accordingly set out to improve:

1.—Permanence, and to obviate loss of activity and consequent wastefulness.

2.—Permeability to heat, and to obviate unequal heating and casing.

Permanence

The supposition that this loss of carburizing power was due to loss of nitrogenous constituents was confirmed by the early experiments. Spent hardening mixture may contain 12 per cent. organic carbon (total carbon, less carbon in carbonates), and yet, under similar conditions, have far less carburizing power than fresh material containing less carbon. Such spent mixture gives indication of only traces of nitrogen. Two similar compositions, one having a much greater carburizing power than the other, gave the following results by the Kjeldahl test:

Composition.	Nitrogen per cent.
Good	2.72, 2.60
Bad	0.51, 0.47

Indirect evidence of the influence of gases (possibly nitrogenous) evolved from the mixture shows that it is possible to carry off the carburizing gases by a current of coal gas in much the same way that oil is removed by steam distillation; on the other hand, heating in gases which contain no nitrogen compounds may carburize mild steel.

The second and concluding portion of this article will appear in our next week's issue.

Direct Current Electric Drive for Overhead Cranes

By R. H. McLain *

The author discusses the design of motor best suited for each of the more common crane service requirements. Methods of speed control and braking as commonly adopted are dealt with at considerable length, while suggestion is made of suitable motors and brakes for the trolley and bridge motions. Protective devices also come under observation.

DURING recent years many improvements have been made in the electrification of cranes with direct current apparatus, both in regard to the manufacture and the design of the electrical material and in the proper selection of equipment to meet the specific requirements.

The service conditions for the various classes of work have been shaped into very definite channels. In some cases a motor is required which will hoist tremendous loads for five or ten minutes at a time and then lie idle for long periods. In other cases, a motor is required to occasionally hoist a very heavy load for a short time and, in addition, is required to keep busy most of the time hoisting moderate loads. Some industries require a motor to operate in a very hot location, and, therefore, demand special noncombustible insulation.

The controller requirements are classified very much along the same lines; but many new possibilities in controllers have recently been worked out. Dynamic braking for lowering is becoming more popular in order to save the expense, wear and adjustment on mechanical brakes and to gain more refined speed control. The "Safety First" movement has invaded cranes and brought about a demand for absolute protection for the operator; this involves the protection of the motor and equipment as well as of the load on the hook.

Power House Cranes.

About the simplest and cheapest class of crane is the one used for setting up machinery in a power house. Once the heavy machinery is set in place the work of the crane is done, except for a few repairs or alterations which must be made at rare intervals. Such a crane may lie idle for weeks. A low hook speed is required and, therefore, no speed control refinements are necessary. All the control and protective apparatus should be made as simple as possible, so that it will be easy for an untrained operator to manipulate, and so that it will not get out of adjustment when not in use. The apparatus should be made as inexpensive and small as is consistent with the extremely heavy load which must be handled when the power house is first built or when additions to the power house are made. While the apparatus should be strong, no especial expense need be incurred to make it stand wear.

Machine Shop Cranes.

The class of crane which serves machine shops comes next above the power house crane in point of severity of service. They have at rare intervals very heavy loads to hoist, but are on duty at all times, serving the machines, bringing up raw material and holding parts in place on the assembly floor and so on. High speed in these cranes is not so important merely for the purpose of moving material rapidly, but is frequently important when the crane occupies such a place that its slowness would keep high-priced mechanics idle while waiting for it. Such a crane requires a series wound motor which can stand extreme overloads, can speed up on light loads, will wear well, and which is light and accessible for repairs. Interpoles come in well on such a motor, because of the overloads and high speeds; split motor frames and large convenient openings to the brushes are well worth while so as to enable repairs being made easily and quickly. Such a motor must be built both for strength and wearing qualities.

A good easily operated controller of the manual type with no live parts exposed to the operator is best adapted to this class of work. Ordinarily there is not enough work done in lowering heavy loads to make it necessary to use dynamic braking; but, if it be used, the controller, and especially the motor, must give high speeds when lowering so as to speed up the work. To obtain this high speed the controller must have a large number of points, and the resistance steps must be just as carefully laid out as is the resistance in the field circuit of an adjustable speed, shunt wound motor, because the crane motor is connected very much like a shunt wound motor or generator when lowering dynamically.

The motor had best be of the interpole type, although a well designed noninterpole motor can lower at 50 to 75 per cent. above its hoisting speed. If correctly proportioned, interpoles are used and, if the brushes be securely and accurately held at the "neutral" position, the motor can easily lower at twice the hoisting speed. An improperly constructed motor either sparks at the commutator or is unstable in speed. In the majority of cases no especial refinements in speed control are needed and ordinary rheostatic control is sufficient; but where very exact work is to be done, such, for example, as requires a uniform speed less than 15 per cent. of full load hoisting speed, it is unwise to obtain this creeping speed by connecting resistance in shunt with the motor as well as in series with it on the first point of the controller.

Such a connection definitely limits the motor speed to any desired low speed regardless of the load on the motor and makes a most desirable condition for such cranes as are required to do delicate work with heavy loads. Foundry cranes whose hook speed is above twenty feet per minute, frequently use this connection so as to take care of pattern drawing. Hand-operated controllers are good enough for this class of work unless careless operators are employed or the motor capacity is greater than 50 to 75 horse-power. Automatic current limit controllers prevent the abuse of the motors and are better able to stand up to service requirements on large motors than hand-operated controllers.

On this class of cranes, the solenoid brake is usually series wound instead of shunt wound so as to get quick action, to reduce the number of trolley wires, and because a series wound coil uses heavier and, therefore, more substantial wire than a shunt wound coil. If a mechanical load brake is used, the solenoid brake need have only sufficient retarding torque to bring the armature smoothly to rest, because the braking action for holding and lowering the load is all supplied by the load brake. About 50 per cent. or less of the normal rated motor torque is all the solenoid brake need exert on the shaft of the motor. More torque would produce too violent a stop.

If dynamic braking be used, no mechanical load brake is necessary, and, therefore, the solenoid brake must not only retard the armature, but must also retard and hold the load. Owing to the fact that the friction losses in the crane machinery help to prevent the load from falling, the brake need only have about 70 per cent. of the torque which is required on the motor when it is hoisting its maximum load. The exact value required depends on the amount of friction loss in the crane hoist.

Powerful action on the part of the brake does not necessarily produce

*Power and Mining Engineering Department, General Electric Co.

violent stopping, because ordinarily the dynamic braking really stops the motor and the solenoid brake only has to hold the load, although in case of dynamic braking should fail to operate, the solenoid brake would have to stop the load as well as hold it. Violent action does take place in the hoisting direction, but this is not objectionable, because the weight of the load helps so much with stopping that the violent action is not felt. Still, if a very powerful brake be used, it will be objectionable in this respect at times, and, for this reason, too much retarding torque should not be demanded of a solenoid brake. It is far better to have a brake just powerful enough, but with ample wearing surfaces so as to be reliable.

Yard Cranes

The class of crane, as regards greater severity of service, next to the machine shop crane, is the shipping yard crane around steel mills. Here speed is everything. Large amounts of raw material must be moved rapidly and on schedule time. The motors and controllers are kept so busy that they should not be worked anywhere near their extreme limits else their life will be impaired. Dynamic braking should be used for lowering, and, on motors above 40 to 50 horse-power, automatic control should be employed. In fact, for dynamic braking it is far more important to have automatic control than for reversible work because it is easier for a careless operator to damage the motor. In very many places it is profitable to put automatic control on all motors so that the crane can make the greatest speed with the least abuse to the motors, and with the least care and skill on the part of the operators.

Special cranes for handling sand, clay, etc., in buckets or lifting magnet cranes work the motor so hard and so regularly, both when hoisting and when lowering, that the temperature rise is the limiting feature. If these motors are not exposed to the weather it will be economical to use open type motors provided a smaller motor could be used without its being too much overloaded at the commutator. Owing to the fact that the maximum loads are easily determined, the motors can be selected with certainty. Dynamic braking for lowering should be used and, since the loads do not vary much from a fixed condition, the controllers and resistances should be designed for the particular condition so as to get the highest speed possible at all times without abusing the motors. Automatic control should be used on motors above 40 to 50 horse-power.

Soaking Pit Cranes.

About the severest crane on electrical apparatus is the crane in steel mills which not only works hard most of the time, but works in a high temperature. Soaking pit cranes and some charging cranes come in this class. Here non-combustible insulation should be used in the motor and, wherever possible, on the wiring of the crane. Accessibility of all electrical parts is of vital importance. Automatic control should be used in all instances unless space or temperature forbid. In come cases there is not sufficient room for contactor panels, and a small manual controller must be crowded in, although it may have to be repaired every few days. While temperature would have no worse effect on a contactor panel with fire-proof wiring than on a hand-operated controller, yet the loss is greater in amount when the contactors are lost, and, therefore, it would in extreme cases be better to use hand-controllers.

Trolley and Bridge Motion.

Only the hoist motion has been discussed above. The trolley and bridge motion are simpler and usually require smaller motors. The motors should be series wound and similar in general characteristics to the hoist motor which is chosen for the crane. The motor should have as steep a series characteristic as possible so that, after exerting its full torque for starting or pulling over bad places in the track, it will rise to a relatively high speed and gain all the time possible. Simple reversing controllers are used for these motors. In most cases hand controllers are employed, but on high-speed cranes automatic controllers are used. No dynamic braking is needed, but sometimes the motors are stopped by reversing them while they are running. If this is to be done, ample resistance should be used on the first point of the controller to limit the current under this condition and thereby permit of gradual stopping.

This method of stopping is not dependable, because it would be ineffective should power fail. Where the trolleys are used for pulling or shoving cars it is advisable to use automatic control to prevent the operator from turning too much power on the motor when it is overloaded. Where automatic control is used for such purposes there should be at least two hand-control points on the master controller so that the action of the motors will not be too jerky. Where no such work is required, the trolley motor need have only one point hand control, but the bridge motor should have two points hand control, because the bridge track is usually uneven, and consequently if only one point hand control were used it would have to provide sufficient power for starting on an up-grade, and it would cause a jerk where the track is down-grade. Ideal conditions are obtained by having two hand points, the first to admit a small current for starting down-grade and the second to provide more current for up-grade.

On ladle cranes, where the trolley motor is used for pouring hot metal it is often advantageous to have one positive creeping speed point on the controller. This point can be obtained by connecting resistance in shunt with the motor as well as in series with it; but no resistance should be connected in shunt with the armature, because there would result a dynamic braking action by the motor if the master controller be thrown to this point after the motor has been running at high speed, and this action would cause the ladle to swing. Solenoid brakes are sometimes used on the trolley motor for stopping, but for satisfactory operation their retarding torque must just fit the needs of the case. Usually 10 to 30 per cent. of the rated motor torque is all that is required of the brake. Too much torque would stop the trolley so quickly as to make the hook swing and jerk. Foot operated brakes are almost universally used for bridge motion because of the gradual stopping which can be obtained most advantageously in this way.

Safety for the Individual.

Crane protective devices have been standardized. On account of the expense and annoyance of replacing fuses they have been practically discarded on cranes; and overload relays in connection with contactor type circuit breakers are used instead. Short circuits and grounds on the crane are relieved by having one single pole breaker and one overload relay in each side of the line. Damaging overloads on the motors are prevented by having one overload relay in the circuit of each motor on the crane. Single-pole knife switches for each motor are frequently used so as to provide a convenient means of tracing out troubles in the wiring. A main line double-pole knife switch is used for disconnecting the crane entirely from the line, and, in order to insure that this switch remains open while repairmen, oilers and painters are on the crane, a staple for locking the switch open is used. Any man who goes on the crane can protect himself by locking the switch with his own padlock. Space for several such padlocks is provided so that each individual can insure his own protection with his own padlock, and thus prevent accidents due to carelessness or misunderstanding on the part of other people.

Safety for the Load.

Safety for the load is obtained by an emergency switch which is installed within easy reach of the operator. The emergency switch should be convenient to operate and so constructed that an operator can open it quickly without exposing himself to live parts or electric arcs. A back-of-board-switch operated

by a front-of-board-knob is best for this purpose, and the switch should be double-pole so as to open both lines. The function of this emergency switch is to shut off all power from the crane and allow the solenoid to set. On dynamic brake controllers it gives extra safety to have the motor hold back in an emergency such as occurs when the solenoid brake fails to hold. Hand-operated dynamic braking controllers always have the motor connected to brake dynamically on the lowering side and at the "off" position, but not on the hoisting side. If there is a case where a great degree of safety is required a normally closed contactor should be used which would establish dynamic braking connections when power fails even if the controller handle is on the hoisting side. Contactor automatic hoist controllers which give dynamic braking should always be equipped with the normally closed contactor. Hot metal cranes and many others are equipped with more than one solenoid brake so as to get additional protection for emergencies.

Hoisting Limit Switches.

Unfortunately there is one problem on the crane hoist which has not been solved to the satisfaction of all users. This is the limit switch for preventing over-travel in a hoisting direction. It is, of course, disastrous to hoist too high, as the ropes may be broken and the hook with its load dropped. In many places it is necessary to hoist very near the limit so as to clear obstructions over which the load is to be carried. Therefore, the operator must use great care. Two types of limit switches are used, but each is objectionable.

The first is a limit switch which shuts off power and sets the brakes when the hook is raised too high. This provides no means of getting power to the motor for lowering the hook and thus penalizes the operator for his carelessness by making it necessary for him to go to considerable trouble to get the hook down. The trouble with this type of limit switch is that much time is wasted every time it is tripped. Incidentally, some one in anger is liable to do something which will prevent the switch from working as designed and thereby defeat its whole usefulness.

The second type of limit switch is one which not only cuts off power when the hook is hoisted too high, but also provides a return circuit so that the operator can return the hook simply by reversing his controller. Such a limit switch will function many times without the operator even knowing it, and for this reason is liable to wear out quickly or lose its proper adjustment. The result is likely to be an accident, because the operator is trained to use the switch and thinks nothing of hoisting too high.

It seems that the only way out of the difficulty is to use the second type of switch, see that it is most substantial in construction and, above all, to inspect its condition and its operation at frequent and regular intervals. The very best switch which can be built should not be left unnoticed to do its work. On one point regarding these limit switches there seems to be a consensus of opinion —that the switch should open the main line power circuit close to the motor and not depend on some control circuit to open a circuit breaker in the operator's cage.—G. E. Review.

PORTABLE ELECTRIC TOOLS.

In a paper read recently before the Ipswich Engineering Society, the author, Mr. Andrew Stewart, said that the only serious rival of the portable electric tool was that of the pneumatic. Until the arrival of the electric tool the only way of getting power in small compass into awkward places was by means of compressed air, and its convenience, in spite of its inefficiency, created a large demand.

Apart from pipe-line losses, the distribution of power by compressed air is inherently uneconomical; and Mr. Stewart claims that an electric drill will do for an expenditure of one horse-power what will require from four to five horsepower delivered to the air compressor in the case of the pneumatic drill. This is taking the compressed air system at its best. "No one," says the author, "has ever had the moral courage to describe the nadir of compressed air inefficiency."

For a decade compressed air held the field in mining work, but with the development of the flame-proof motor electricity began rapidly to oust it. This change led engineers who were using compressed air for other industrial purposes to question its economy. Thus arose the demand for the electric tool; and the first attempts were frequently made "more from the electrical than the mechanical standpoint," with the result that the electric tool was not always fit for its work. In a number of cases small fan motors were used, merely being put in a case which contained the requisite gearing—a striking example of the inherent laziness of human nature. In the end the longest way round proved the shortest way home.

Designers eventually set to work to produce a machine large enough and strong enough to meet the heavy conditions to which it was generally subjected. There was an intermediate stage at which various safety devices, such as special fuses, slipping clutches, and overload alarms, were installed in order to prevent the electrical part of the tool from being overworked. Some such devices are still in use, chiefly on tools of German manufacture, since—according to Mr. Stewart—our Teutonic friends are inclined towards building an inherently weak machine with more or less adequate safeguards. The soundest line of progress, however, appears to be towards the self-sturdy tool.

Technical Problems Involved.

The two main technical problems involved are those of insulation and ventilation. Textile and other ordinary insulating materials have limits of temperature rise which are too low for practical purposes unless the ventilation is very good. The author spoke very hopefully of the use of a metallic oxide on the wire itself. "While such salts," he says, "have, comparatively speaking, poor insulating properties, they are in some cases as indestructible as the wire itself." With regard to cooling the motor, the plan of using forced ventilation (introduced by Mr. Duntley) is now in general use.

A diagram accompanying the paper indicated the great improvement which had been made in the efficiency of portable electric tools. Coincident with this improvement there had been a great advance in reliability, but it remains true that the results obtained from an electric tool depend to some extent on the user. The author remarked that the average workman is none too sympathetic towards labor-saving tools of any kind; therefore, a large factor of safety has to be allowed.

Another human touch in the tool business is that the maker has to think of appearances. "An engineer," said Mr. Stewart, "frequently chooses a machine for the same reason as many another man would choose a wife, not so much in the hope of deriving economic advantage from the object of his choice, but chiefly because he likes the look of it." To which we may add that beauty of design is, unlike female loveliness, more than skin deep.

Earning and Collecting.—It has been stated that the reason why so many capable men—those who have done things for the uplift of humanity and the advance of civilization—are so shockingly poor is because they have been so busy earning as not to have had opportunity to collect. On the other hand, there are all too many examples in evidence of those who are so busy collecting as never to have earned. It may be said, however, without fear of contradiction, that the man who does not earn more than he is paid does not lead a really useful life.

PRODUCTION METHODS AND DEVICES

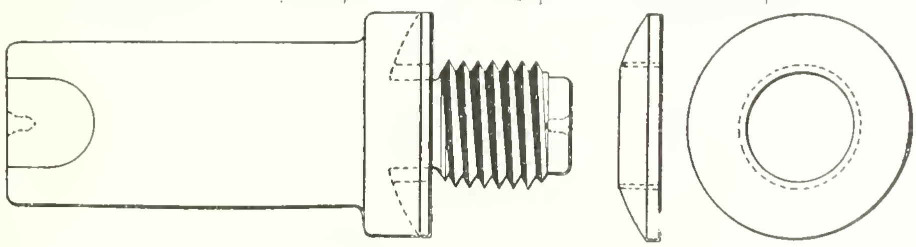
A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

NUT ARBOR FOR ACCURATE WORK.

IN a western plant building large numbers of hoisting and contractors' engines considerable trouble was experienced with the fitting of piston rods and cross-heads. These often bound when the nuts were tightened up, and quite a number of rods broke in service in the threaded part. The thread was a special one of ten to the inch, roughed out on a three-inch turret lathe and finished on an engine lathe.

The trouble was found to be with the lock nuts not being faced square with the thread, which tended to buckle the rod when tightened up against the cross-head. The trouble was completely overcome by making a set of nut arbors, shown in the cut. This arbor is similar to the ordinary one, except that the nut backs up against a loose washer, which is fitted to a spherical seat. As the nut tightens up, the face of the washer adapts itself to the back face of the nut, which, of course, is thus set according to the thread.

Not having the best facilities for making these arbors, the method adopted may be interesting. The arbor was finished all over as accurately as possible



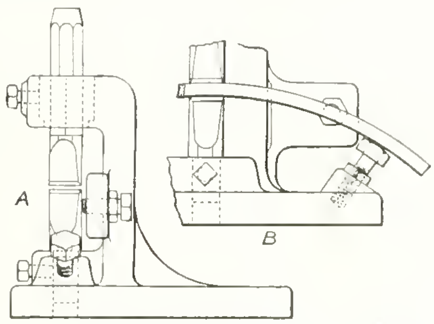
NUT ARBOR FOR ACCURATE WORK.

in the lathe, and the whole hardened, except the back end. After lapping the thread and the seat for the washer, the back end was cut off, the arbor was screwed into a nut bored and threaded in the lathe to fit snugly, and, while being held in this way, a new back centre was carefully drilled and reamed. The local hardening of this centre completed the tool, which has been in use a long time and has given little trouble.

SIMPLE PISTON RING SPLITTING DEVICE.

The device shown in the accompanying illustration, while simply an experiment in the first place, proved so satisfactory in its work that it was finally adopted as a means of splitting all the smaller-sized piston rings.

As will be seen, it consists simply of two chisels so adjustable that they can be twisted to any angle and directly in line with each other. The shank of the lower one is turned down to a shoulder to fit a hole in the base of the body casting, where it is fastened by means of a set screw. The upper chisel is planed square in the centre to a shoulder at each end of the square part for the pur-



SIMPLE PISTON RING SPLITTING DEVICE.

pose of limiting its motion. This square is a sliding fit in a split steel collar, which is fastened in the top part of the fixture also by means of a set screw. A spring was first used to keep the top chisel up off the ring, but this seemed to cause a number of them to break in the wrong place. Screws are provided for adjusting the ring to the proper angle as well as for centering it.

The ring is placed in position; the top chisel is struck a smart tap, and after the two cuts have been made, the piece can be very easily broken out. This, no doubt, will seem to most mechanics a rough way of fitting pistons, but tests after the engines have been run off have shown these pistons to be fully as steam tight as others of the same size and with spring laboriously fitted by hand. It has been suggested that the rough surfaces of the ends tend to retain grease and other material which assists to prevent steam leakage.

It has been found that the tools can be so ground as to leave very little burr on the ends of the ring, and as the work is entirely done at little extra cost by the man who assembles the pistons, a considerable saving is accomplished.

SOLDERED JOINT QUERY.

By J. N. Ellethorn.

IN a recent issue of Canadian Machinery a reader wished to know why soldered joints will not prove satisfactory on steam coil joints. Solder, commonly known as tinsmith's solder, is made from equal quantities by weight of block tin and lead. Again, plumber's solder, which is used to make wiped joints has a larger quantity of lead than tin—usually about three of lead to two of tin by weight.

Steam at 100 pounds gauge pressure has a temperature of 327.625 degrees Fah. Tin melts at a temperature of 444 degs., lead at 614 degs.; half and half melts at 466 degs., and two to one at 475 degs., Fah. In view of the foregoing, it requires no great knowledge to understand that with steam at a high temperature passing through split pipes with soldered breaks, the solder will become very soft and weak. The pressure will soon force the solder apart as the pipe expands at the break, for as the solder becomes heated it looses its power to hold together the two sides of the split.

Even on low pressure steam-pipes a soldered joint is not to be recommended as the expansion of the solder and the iron pipe is altogether different. For example: the linear co-efficient of expansion for iron for each degree increase in temperature is .00000686, for steel pipe .00000599, and for tin .00001410. Positively no soft soldered joint should be used on a steam pipe. For hot or cold water or any cold gas pipes it is all right if the pressures or temperature changes be not too great, because the tensile strength of solder is away below that of iron.

ELECTRICAL FIRES.

By J. E. Noble.

In most cases the chief engineer in large office buildings and factories has charge of the electric wiring for power and light. In hundreds of cases where fires occur, the blame is wrongly placed on such wires, although on the other hand it is a settled fact that many fires are caused by wrong placing or misbehavior of conductors. When proved cases of such fires occur they should be brought to the notice of all chief engineers. The following are a few that have been reported in electro craft from time to time, and although greatly condensed, I think they contain all the in-

formation necessary to make them of value to engineers in charge.

(1)—A gas fixture had been removed from a corridor on the upper floor and the wires left lying against a gas pipe. The insulation becoming old, the bare wire came into contact with the pipe, and there being a ground already on the service, an arc was formed. A small hole was burned in the pipe and the gas ignited.

(2)—A 500-volt motor was installed in a small room in a grain elevator. Dust was allowed to accumulate and was ignited by sparks from the brushes. A dust explosion followed.

(3)—Several distribution feeders to lights were run in paper conduits. Some of these conduits were in a channelway adjoining a metal lined air shaft. In fastening the metal lining in place, the nails were driven into the channelway and through the paper conduits containing rubber covered wires. The vibration of the building caused the nails to wear away the insulation of the wires. The arc thus formed set fire to the insulation, to the paper conduits leading to the air shaft, and finally appeared in the attic of the building. Tests made subsequently showed that a 50-ampere fuse in the feeder wires would not blow before a fire was started in the channel-way.

(4)—Cables in a tunnel leading from a large generating station were bunched closely together instead of being properly separated. A short circuit occurred on the system and produced such a heavy rush of current in the cables of the tunnel that their insulation melted away, exposing the bare copper. A very vicious arc was formed, and the insulation caught fire, which was in turn communicated to the power house.

(5)—A fire took place in a dwelling where unenclosed plug fuses were placed in the attic. A short circuit occurred at a fixture which blew the fuses, set fire to some wearing apparel and then to the building.

(6)—Old-style insulating joints for combination gas and electric light fixtures allowed gas to escape, which was ignited by small sparks between a grounded wire system and the fixture. The fire was thought to be extinguished, but crept along the insulation of the wires (weatherproof) in a furred wall and broke out later in the attic.

In some of these fires, damage to the extent of $200,000 was done, making it apparent that it pays to look carefully after the wires.

The A. D. Reid Co., of Toronto, have been awarded a contract for the construction of an incinerator by the city of Stratford, Ont.

MICSELLANEOUS QUERIES.

Editor Canadian Machinery:—I would be much obliged if you would answer through the paper the following problems:

(1)—How would you determine the crushing strength of a plain furnace?—A. Langridge.

Answer.—Formulae for the determination of the strength of furnaces and flues cannot be deduced by direct reasoning, and are, therefore, the results of experiments. The most used formula, known as Fairbairn's, is $p = 9{,}675{,}600 \dfrac{t^{2 \cdot 19}}{l\,d}$

Where p=pressure in lbs. sq. in.
t=thickness of metal in inches.
l=length of flue in inches.
d=diameter of flue in inches.

For all practical purposes t^2 may be used instead of $t^{2 \cdot 19}$ and the formula becomes $p = 9{,}675{,}600 \dfrac{t^2}{ld}$

The British Board of Trade prescribes the following formula for welded flues:

$$p = \frac{90000\ t^2}{(L+1)\ d} \quad L = \text{length in feet.}$$

For lap joints and inferior work the 90000 may be reduced as low as 60000, according to judgment of the engineer.

Example.—What would be the crushing strength in pounds per sq. in. of a flue ½-in. thick, 10 ft. long and 30-in. diameter?

$$\text{From formula, } p = 9.675600 \times \frac{(\tfrac{1}{2})^2}{10 \times 12 \times 30}$$

$$\text{or } p = 9{,}675{,}600 \times \frac{\tfrac{1}{4}}{10 \times 12 \times 30} = 671.6 \text{ lbs.}$$

per sq. in.

Or the working load using a safety factor of 6 would be $\dfrac{671.6}{6} = 112$ lbs. sq. in. approximately.

(2)—How do you determine the load that can be supported at the centre of an iron beam, the tensile strength of the material being known?

Answer.—The standard beam formula is $\dfrac{M}{S} = \dfrac{I}{C}$

In which M=maximum bending moment. This depends upon the manner and amount of loading. For a concentrated load in the centre of a beam the bending moment would be $\dfrac{PL}{4}$ where P=load and L=length. If the weight of the beam itself is to be considered the bending moment of the beam or dead load would be $\dfrac{WL}{8}$ where W = total weight of beam and L = length. For total moment these two should be added together.

S = maximum tensile stress in the material in pounds per sq. in.

C = the greatest distance from the centre of the beam to the outside.

I = moment of inertia, the value of which can be found in most engineers' or steel hand-books. Thus, for a rectangular beam placed on edge I would be $\dfrac{bd^3}{12}$ — where b = breadth and d = depth.

For regular rolled sections, the values of I for all sizes are given in the steel hand-books.

Example.—What concentrated load could be supported by a steel beam placed on edge, 1 x 6 x 4 ft., between supports. Allowable stress=20,000 lbs. sq. in.

$$\text{Formula, } \frac{M}{S} = \frac{I}{C} \text{ or since } M = \frac{PL}{4}$$

$$\text{Formula, } \frac{PL}{4S} = \frac{I}{C} \text{ or } P = \frac{I \times 4S}{CL}$$

$$I = \frac{bd^3}{12} = \frac{1 \times 6^3}{12} = \frac{1 \times 216}{12} = 18$$

C = 3 in.
S = 20000.
L = 48 in.

$$\text{or } P = \frac{18 \times 4 \times 20000}{3 \times 48} = 10000 \text{ lbs.}$$

or half a ton.

Note.—In this case the weight of the beam is not considered.

Repairs and Welds by Electricity.—In a paper on "Repairs and Welds by Electricity," presented before the Ohio Society of Mechanical, Electrical and Steam Engineers, it was stated that a large locomotive shop operating an electrical welding apparatus, having made a careful tabulation of the total cost of the repair work, including material, time of the operator, the current and overhead charges, obtained an average cost of 1 cent per minute. The saving effected by this method is shown in the following example:—The cost of repairing forty cracks in side sheets of fire-boxes by means of the metal electrode method was $6.35, while to renew the damaged parts would have cost about $1,300.

The William Hamilton Co., Peterboro, Ont., have recently closed contracts with the Corporation of Megantic, Que., and the Corporation of Merrickville, Ont., for hydraulic machinery amounting to $25,000.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

TEAM WORK IN A BRASS MANUFACTURING PLANT.

By P. W. Blair.

UP-TO-DATE brass manufacturing plants, making plumbing, steam, gas and water-works brass goods have in the past few years installed many of the latest and most up-to-date tools and machines for the production of their goods, with the result that the quality and diversity of these latter have increased in proportion.

The brass foundry, viewing it from all points, presents a unique problem in the mechanical line. The process of work in the machine shop, finishing departments, or pattern ship is more or less mechanical, and because of this, individual ability stands out more prominently than in the foundry. Mechanical ability is not, however, lacking in the foundry, and if the work produced were dependent only upon the skill of the individual molder, the efficiency of that department would measure up equal at least with other branches of the plant. The production of castings, however, is dependent not only on a mechanical process, but also on a chemical process. Even with the most up-to-date methods, it is impossible to individualize mechanical ability, or with any degree of certainty to fix the responsibility for defective work, and yet there is a reason for the loss of every spoiled casting. Some one unit of the department failed in performing its part of the work correctly.

Causes of Defective Castings.

It may have been due to the careless work of the molder in making the mold or pouring it; it may have been due to lack of care on the part of the coremaker in making or venting the core; it may have been due to poor judgment in the selection of sand not suited to the class of work to be produced, or it may have been due to poor tools and appliances. A purchasing agent, in order to save a few dollars, may buy poor grade materials, such as copper containing aluminum, which, through ignorance on the part of the melter, might be used for hydraulic fittings, and the mistake not discovered until the castings failed under test, when it is too late to correct the error. Again, the failure may have been caused by bad scrap or poor furnace practice. The fault lies somewhere, and a systematic search or inquiry should reveal the cause and fix the responsibility upon someone.

In the other departments aside from the foundry, mechanics can forge ahead of their fellows and become experts in their particular line. They can individualize their work and reap the benefit of their skill. In the foundry, however, all the skill possible for the molder to possess could not prevent the loss of his work if the other units of the department failed to do their part with equal skill. The foundry is in a class by itself in the mechanical world. Instead of working for individual records, team work must be established. Every element, every unit must work with but one purpose in mind: the success of the department in the production of perfect work not part of the time, but all the time. When the finishing departments receive perfect castings they may cut the cost of manufacture as much as 10 per cent., because true and unwarped castings are machined more readily and are handled with ease, as they accurately fit the jaws of chucks or jigs in the course of manufacture.

In a Class By Itself.

A certain portion of the work in a foundry is intrusted to unskilled help, to men who do not understand the necessity of following out to the letter the instructions given them; who cannot see how far-reaching the effects of their indifferent work may be, what loss it may cause, or the wrong reflection it may cast on the ability of the molder. Such men cannot be blamed for something they do not know, but they can be helped and taught to perform their part of the work as well as the necessity of attaining perfection in it.

To emphasize the necessity for team work in the foundry, a lesson can be learned from watching two hockey teams in a game. The writer witnessed two crack Ontario teams—the Kingston Frontenacs and the Sarnia Independents—engage in a match game on January 31. The success of any hockey team is dependent first on skill, and second on team work, the latter being just as necessary as the former. The greatest responsibility in a hockey game rests with the goalkeeper, but let him be ever so skilled in his profession he will go down to defeat if the other units of the team do not support him. The light-weight Kingston players with their team work and brilliant defence of their goal were able to hold a heavy-weight and highly skilled individual team to a tie score in one of the fastest games ever played in Sarnia.

There is no reason why any up-to-date brass manufacturing plant cannot be brought up to as high a state of skill and perfection as in any other branch of mechanics or trades. All it requires is to adopt the team work idea, and install an educational system that will bring the various working units up to a thorough understanding of their duties. Every man must be taught to recognize and understand the responsibility of his work, and to do it along this line. Every unit of these departments must be impressed with the fact that some one man's work, if improperly performed, will lead to the loss of some particular job.

The old foundry slogan, **any molder is liable to lose a casting,** was not coined because of a desire on the part of the molders to admit that they lacked mechanical ability, but because it has always been recognized that too many things entered into the production of their work, some of which might easily prove faulty. Molders as a result have recognized that they were individually helpless in their efforts to be perfect. It is a big task to bring about perfection in a brass manufacturing plant, and more especially in the foundry, but it can be done, and up-to-date plants will do it for economic reasons, as well as for the sake of raising the efficiency of the molder up to a level with the mechanics in other departments of the plant. That the molders would give such a move their hearty support goes without saying. They would hail with delight any system that would help them to attain greater perfection and relieve them of the strain of carrying the burden of responsibility for the production of defective castings for which, in the majority of cases, they are in no way responsible.

The men in viewing this question must get one thought imbedded in their minds. If a worker is not wholly to blame for poor castings, then from the same viewpoint he is not deserving of all the credit for perfect work. The same factors that entered into the production of the imperfect castings were apparent in the production of the perfect work, except that in the latter case men worked in unison and perfect team work was accomplished. He must recognize that, in the face of all the skill he may possess and display in his work, his

efforts may go for naught because of the lack of skill displayed by one or more of his team mates, and whose efforts are just as essential as his own for the success of the work produced.

GIANTS AND WEAKLINGS.

By James E. Cooley.

The great workers, they who have done the really great things, the things that endure, that lift men up from one stage to another, are very few in number compared with the teeming millions of inhabitants on this vast globe. We know who they are, among the living and the dead; we know of their achievements and the benefits that have resulted from their labors. Set apart and gazed at by the world, they occupy but a very small space on the surface of the earth; a few square miles at the most. It is estimated that the earth's surface is about 200,000,000 square miles, and, it is readily seen there is still plenty of space for a few more notables, a few more capables, a few more individuals who can become great.

The seemingly little efforts that have become great achievements, the seemingly small things that have become wonders, were first wrought and thought in the brain of man. There are no accidents or circumstances in this life that lead men to greatness. Hard pulling strokes, intensified thinking coupled to intensified action is what does it. Your whole life is daily mapped out keyed up by your thoughts or the number of these that develop into actions.

When a new invention has been brought forward, there are those who rise up and try to get the credit for what another has done on the ground that they had thought of the same thing before. Failure to put a thought into action bars every claim, for he that thinks must also act. The whole secret of success or failure depends on the largeness of thought, and the extent to which that thought is put into action. Greatness comes or mediocrity continues according to its goodness, its hard hitting, telling action on the one hand, or its baseness, weakness and fickleness on the other. You cannot move without taking thought. It takes the same amount of thinking to go downward to disgrace and defeat, as it does to go upward to distinction and victory.

Thought put into action is the secret of life's great achievements. The conveniences you have, the benefits you enjoy, never come of themselves — never just happen so. They have come by hard, vigorous thoughts and actions, the work of brain and muscle, from a head with bulging temples and distended veins, and hands whose grip is vise-like. Out there in the passing, lagging throng, some one brain is going to generate a new thought that when developed into action, will infect other minds and bodies and turn that throng into hustling, bustling beings. Somewhere, some day, on the great highways of the world some one will produce a thought and turn it into action that will advance the world forward one hundred years. Will it be your brain that will do this? Will it be your brain that will cause a listless race to wake up? Will it be your brain behind the hand that will pull the throttle over to speed on faster the car of progress?

We marvel when we think of the things that have been done. We ought to marvel more at our backwardness, deadness, our slow movements. We ought to advance faster, we ought to accomplish more. There ought to be more great men among the numbers that people this earth. There ought to be more giants than weaklings. There is a great deal to be done. Everything is possible to him who thinks and then goes ahead, to him who thinks and puts those "thinks" into action. Thoughts are not things until they materialize, and they don't materialize till the brain that produces them, converts them into visible, humanly useful objects.

Every object was once a thought before it became what it did, everything animate or inanimate was once a thought, even the creation itself. Know then this fact, that "thought put into action" is the answer to the riddle of the universe. Just by thinking, and belting up your thoughts to vigorous action you will "strike your gait," and make the world sit up and take notice.

Here then is your opportunity. Just one new thought put into action, some one strikingly useful thing, and your name is on every tongue. Posterity will know you by that one thought; will know you for the interest you took in the world in your own day and theirs, a labor for the betterment of mankind which will have come down to them; know you as a great famed figure painted on stretch of canvas that will hang in the "gallery of the world's achievements."

Here, you see, opportunity awaits you; here you see what a thought will do for you; here's your hope, here's your chance, here's for you immortality.

UNIFORM BOILER RULES FOR ALL CANADA.

Representatives from every province in the Dominion, with the exception of Alberta and Manitoba, are meeting at the Parliament Buildings, Toronto, to consider uniform boiler inspection regulations for all Canada. At the present time Alberta, Saskatchewan and Ontario have uniform regulations. British Columbia has regulations that vary somewhat; Manitoba is about to adopt a series, while the other provinces are merely in the "considering" stage.

The conference is of considerable importance to boiler manufacturers, and their representatives will doubtless keep closely in touch with the sessions. If uniform regulations are adopted it will mean that boilers inspected and passed upon during construction can be sent to any part of the Dominion and put into operation without further inspection or suffering any penalty in pressure imposed as a safeguard.

Those attending the conference are J. Peck and R. N. Blackburn, chief inspectors of boilers in the Provinces of British Columbia and Saskatchewan respectively; W. G. Matthewson, of Nova Scotia; P. T. Tobin, inspector of public buildings, Province of Quebec; and D. M. Medcalf, chief boiler inspector, Province of Ontario.

CANADIAN KODAK CO. NEW FACTORY.

Work has been started on the new plant which the Canadian Kodak Company will erect at Kodak Heights, in Mount Dennis, where they own a parcel of 25 acres of land, of which twelve hundred feet has frontage on the Canadian Pacific Railway tracks. Since 1900 this company has had to build three times to take care of its growing business, and it is the intention to transfer the entire industry, now located in three buildings on King Street west, to the Kodak Heights works as soon as they are completed. The officials of the company anticipate that the new plant will be ready in about two years at the outside.

Buildings have been specially designed for the manufacture of kodaks and other cameras, film, dry plates, photographic papers and sundry articles for photographic use. The new plant will consist of seven buildings, with a floor area of more than 480,000 square feet, or about 11 acres. The largest building will be 460 feet long by 80 feet wide, five storeys high. The plans call for reinforced concrete construction, with metal sashes glazed with wire glass.

The power plant is designed to accommodate boilers of 3,000 horse-power, with an immediate installation of 1,500 horsepower. Electrical energy will be supplied by three steam-driven generators, with a capacity of 1,000 horse-power. A striking feature of the power plant will be a chimney 200 feet high and 9 feet in diameter at the top.

Reuben R. Penney has been appointed harbor master of the port of Barrington, N.S.

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

With the further development of this course in arithmetic, it will be found by those who have followed the introductory lessons and profited by them that the various practical applications resulting from the succeeding lessons will be easily observed and their time and labor-saving features so appreciated as to be adopted at every available opportunity.

THREAD CUTTING.

THE practice of screw-cutting on the lathe involves some interesting and often complicated figuring in arithmetic; and while the modern lathe, to some extent, eliminates the changing of gears for the different pitches of screws being cut, there are still many lathes, both new and old, with the old style of change gears, which must be calculated and set up for each different pitch of screw; in fact, the necessity of having one or more of these lathes in a plant, especially in jobbing shops, where many threads of odd pitch are constantly being met with, will appear quite evident, as the majority of quick-change gear lathes have only a specified number of pitches which can be cut.

A workman after operating a quick-change gear lathe for any length of time, will have some trouble figuring out a train of gears for an odd pitch which must be cut on another lathe. When cutting threads in the lathe, the saddle upon which the cutting tool is rigidly secured must travel in a certain relation to the speed of the lathe spindle in order to cut the required pitch.

Now, as the master screw or lead screw always remains the same, it will be seen that the train of gears connecting the lathe spindle with the lead screw must be so arranged that the proper ratio between the lead screw and the thread being cut will be retained. In the majority of lathes the spindle stud which carries the first of the change gears is usually placed somewhat below the lathe spindle, and in most cases has a ratio to the lathe spindle of 1:1; that is, one revolution of the lathe spindle will give one revolution to the stud S. (Chart 22.)

On a lathe having a lead screw L of four threads per inch, it is desired to cut a thread having four threads per inch. The ratio between the lead screw and the thread being cut is seen to be 4:4 or 1:1; then the gear A must have the same number of teeth as the gear D. The intermediate gear B connects the gears A and D, but the gear B in a single train has no effect on the ratio of A and D.

By formula, A:D=L:T.
40:40=4:4.

Suppose we wish a screw of 1/10-in. pitch or ten threads per inch cut on the above lathe. The ratio in this case becomes A:D=L:T, or A:D=4:10=1:2½.

Select a gear for A, with a small number of teeth and divisible by 2, say, 30. Then by formula,

$$D=\frac{A\times T}{L}=\frac{30\times 10}{4}=75 \text{ teeth.}$$

When selecting the gear A for stud S, always take one that is divisible by the denominator (if any) of the fractional part of the ratio.

Required to cut 11 threads, with a 4 thread lead screw.

Ratio=4:11=1:2¾.

Select for gear A one that is divisible by four, as 20, 24, 28, 32, etc. When gears increase by 5 we must take 20 or 40. Then,

$$D=\frac{A\times T}{L}=\frac{20\times 11}{4}=55 \text{ teeth.}$$

Discretion must be used when selecting gears, so that those belonging to the lathe will work into the solution. To cut 11½ threads with a 4-thread lead screw, gears increasing by 4 from 24.

Ratio=4:11½=1:2.875

$$D=\frac{A\times T}{L}=\frac{24\times 11.5}{4}=69 \text{ teeth.}$$

or, taking gear of 32 teeth for A, we have

$$\frac{32\times 11.5}{4}=92 \text{ teeth.}$$

Suppose we have a thread of 1/16-in. pitch (16 threads per inch) to cut with a 2-thread lead screw, gears increasing by 5 from 20.

Ratio=2:16=1:8,

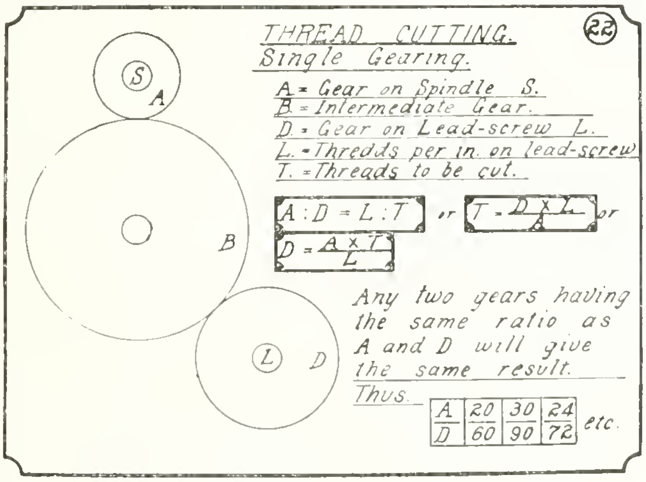
then, using gear of 20 teeth on stud S we have

$$D=\frac{A\times T}{L}=\frac{20\times 16}{2}=160 \text{ teeth.}$$

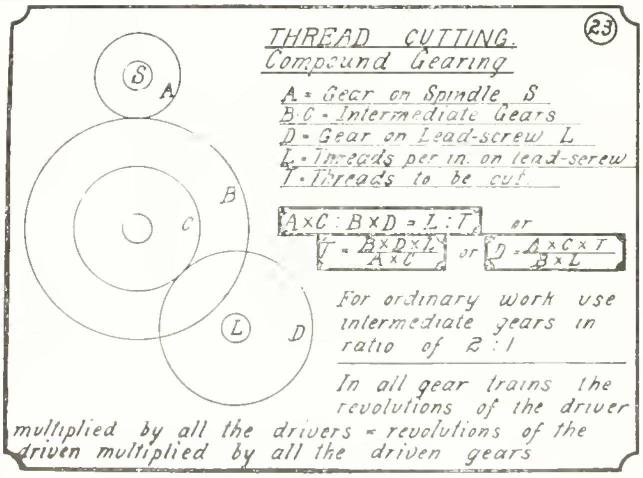
Now it seldom happens that a gear of 160 teeth goes with the lathe, and it becomes necessary to compound the train of gears connecting the stud with the lead screw. To accomplish this we divide 160 by 2, which gives 80 teeth for the gear to use on the lead screw; then for the intermediate pair C and B (Chart 23) we must select two gears having a ratio of 2:1, or 60:30, or 90:45, etc.

By formula, A×C:B×D=L:T, therefore,

$$T=\frac{B\times D\times L}{A\times C}=\frac{60\times 80\times 2}{20\times 30}=16 \text{ thds.}$$



ARITHMETIC CHART 22.



ARITHMETIC CHART 23.

Mellen's Creed and Maitland's Prayer Contrasted

If any are still skeptical of the development and progress being made in the elimination of the purely mercenary feature in the administration of our large industrial and commercial enterprises, the following article culled from the Chicago Evening Post may be worth their careful study. Readers generally, we presume, are more or less familiar with New Haven Railroad affairs.

"ALL I was after was results for the New Haven road, and I would have done business with the devil himself, if necessary."

Charles S. Mellen here put into words the spirit of a day that is gone.

Set over against it an incident of the day that is coming.

At the annual meeting of the United States Steel Corporation a few weeks ago, Chairman Elbert H. Gary presided, but among the stockholders all were not of the type that this powerful name suggests. There were in the crowd stockholders in the United States Steel Corporation who were "puddlers" and "heaters" and "rollers" in the company's mills.

Workmen Express Confidence.

One of these was Samuel Wilkinson, who is a working man in the Elwood City plant. He came as the representative of 921 stockholders who work in that plant. He brought no complaint, no grievance. "The funniest thing," he said, "is that not one of the working men has been to me since I was chosen by them to come here and told me to say anything. They just put their confidence in me to tell what the working men think of the corporation."

He told it. He said that the men thought "a good deal" of the corporation, and he told why. He told how the company's sanitation campaign saved its workers from being exposed to swarms of insects, to foul drinking water, to the rain and the snow. He was "not here to praise the company," but its accident-prevention work made it safer for him and his fellows to go to work without taking their chances in crossing unguarded tracks. He said that the "safety devices" on the machinery were "working fine."

Safety Campaign Results.

Chairman Gary had pointed out that this campaign had cut down the accident roll until it was 38 per 1,000 men less than in 1906. "This means that 2,273 men who might have been injured under earlier conditions were saved from serious injury during the year." In 1913 the corporation spent $600,593 in this work.

No Higher Tribute.

Samuel R. Maitland, stockholder, and "water tender at 3 and 4 boiler house" in Newcastle, Pa., took up the story that Wilkinson began. "The workers at Newcastle are pleased with conditions." The vacant lots have been cleaned by the corporation and made into parks. There were playgrounds for the children. There were visiting nurses. There was the safety campaign, which kept the "mothers from having their boys crawl home to them cripples," and there was the pension system. An old man meets me on the street and says: 'I am on the pension roll.' I say: 'You ought to thank God for that.' He is not a pauper.

Then came the most moving incident of all. This simple workman said in closing: "We ought to look up and thank God for this great corporation, which is taking care of humanity in this large way; and now, if you will just bow your heads, we will offer up a little prayer, if that will be all right."

"Of course, there is no objection," said Mr. Gary. And the workman prayed: "Our God, we thank Thee for these officials and these good men who have taken such an interest in the welfare of humanity, and rejoice in our hearts for the blessed privilege of looking up to Thee in thankfulness for it. We would pray for the man who works and for all who keep us together as one great family and organization. In Thy name we ask it. Amen."

The simplicity of the man's assumption that nothing could be more fitting than a religious interpretation of this new spirit of "big business" was a finer tribute to the Steel Corporation's sincerity than all the approval of scientific sociologists. To him, these men whom Mr. Gary personified were but carrying on the work of the Lord. They were applying on earth His gospel of justice and mercy. It was but proper to offer thanks to the Source of All Good.

When Mr. Mellen grates out the harsh gospel of the old order, a watchful press dramatizes it before the people. When a working man phrases in dramatic surroundings the new spirit of the industrial age, a strange perversity makes us ignore it and keep it out of our headlines. Yet, to our mind, the words of Samuel R. Maitland, water tender, are more significant to-day than those of Charles S. Mellen, the former chieftain of the New Haven. The one breathes the appeal of unscrupulous selfishness to the devil himself. The other lifts up its eyes unto the hills from whence must come the help which will solve for us the troublous problems of industry.

To-day, as the United States faces in the New Haven probe a drama that may be as great as that of the Hughes life insurance investigations, "Maitland's prayer" should find in the consciousness of the public as firm a place as Mellen's malignant creed. The one preaches despair, the other hope. It is the old against the new, as we measure economic eras, but in the larger measure of time, the "new" is itself as old as the world.

TRADE COMMISSION SITTINGS IN TORONTO.

The itinerary for the Dominion's Royal Commission, the Imperial trade body, which will arrive at Sydney on August 3, and will travel across Canada taking evidence in regard to every phase of Canadian trade, has been arranged.

The commission will be in Montreal on August 24, 25 and 26; in Ottawa, August 27, 28 and 29, and in Toronto on September 1. A number of excursions to Hamilton, Niagara Falls and other places will be taken from Toronto, while several days will be spent in Western Ontario. The commission will then leave for the West, and will arrive in Winnipeg on September 15. Thence it will proceed to Regina, Edmonton, Calgary, Banff, the Okanagan Valley, Vancouver and Victoria.

A great deal of information is now being secured and arranged by experts in advance of the commission's arrival. Among the subjects on which information is being secured are ocean freight rates, the most important matter with which the commission will deal; duties, patents, fisheries, forestry, mines, taxes, irrigation, grain inspection, development of harbors, etc. A quantity of such information which has already been prepared was lost when the Empress of Ireland went down, and has to be replaced.

A number of witnesses will be heard by the commission during its meetings in Montreal and other big Canadian cities. The St. Lawrence route, it is understood, will be one of the chief matters dealt with. Ocean freight rates is also a topic upon which it is expected the commission can obtain considerable light in Montreal, and it is probable that a considerable portion of its time in that city will be spent garnering information in connection therewith.

James Buchanan, of James Buchanan, Ltd., Liverpool, England, has arrived in Halifax, N.S., in connection with the installation of machinery which his company has supplied to the Acadia Sugar Co., of Dartmouth, N.S.

PROGRESS IN NEW EQUIPMENT

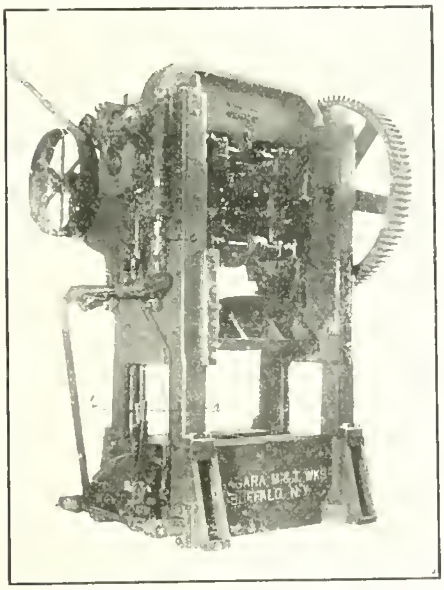
A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

DOUBLE CRANK PRESS WITH CLUTCH SAFETY CONTRAL.

THE accompanying illustration shows a large press with a novel device to control the action of the clutch and the motion of the slide. It permits the stopping and starting the friction clutch at any time during the downward motion of the slide, and will also stop the cross-head automatically in the highest position. The clutch is non-repeating. The controlling hand lever returns automatically to its starting point, and is locked in position after the slide reaches the highest point.

In order to start the clutch the operator takes hold of lever A, at the same time disengaging the locking lever B. Pulling the lever A forward to the outer end of the segment, engages the clutch. The lever B controls the action of a plunger engaging the connecting-rod C, i.e., when the lever B is disengaged the connecting-rod C is also released, and the clutch lever A is free to be moved forward to engage the clutch. The return motion of the clutch lever is accomplished by a cam fastened to the outer end of the crank-shaft.

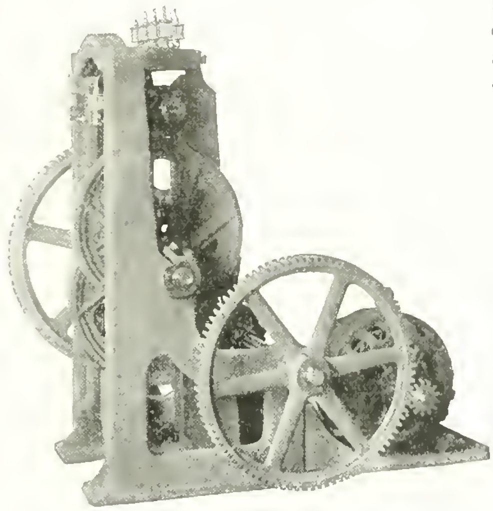
This machine has been designed and built by Niagara Machine & Tool Works, of Buffalo, N.Y., and the improved feature can, we understand, be applied to other sizes and types of presses equipped with friction clutch. The press illustrated has the same conveniences for adjusting, etc., as other large presses built by the Company, and the driving mechanism being arranged overhead, makes the machine accessible from all sides.



DOUBLE CRANK PRESS WITH CLUTCH SAFETY CONTROL.

A NON-PULSATING PUMP.

Interest in the pump shown in the illustration lies in the fact that the pistons are not operated from a crank shaft, as in the ordinary type of reciprocating pump, but by cams. The cams are keyed to the main shaft and each transmits its motion to its piston by means of a sliding yoke, rollers being used to minimize friction between the cam and the yoke.



A NON-PULSATING PUMP

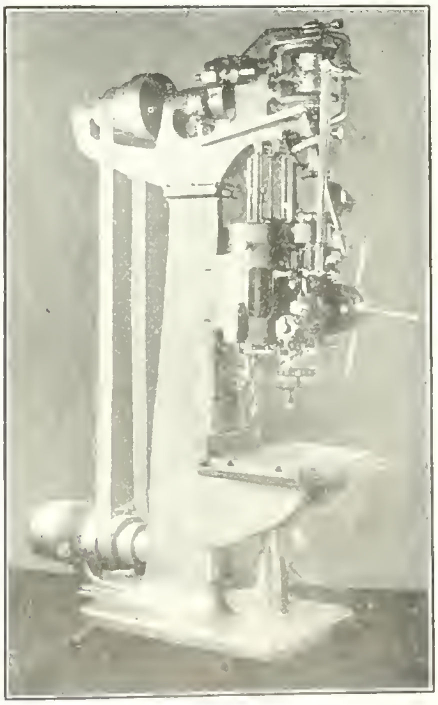
The manufacturers claim that this construction keeps the load on the piston uniform instead of passing through a cycle running from full load to a complete stop and back again, as in the crank shaft pump. Hence there is no pulsation, less strain on the pump, and high efficiency owing to the absence of backlash when gears and other parts become worn. In fact the manufacturers guarantee an efficiency of 80 per cent. for the pump, which is higher than can be obtained from the ordinary crank shaft pump.

The Luitweiler Pumping Engine Co., Cleveland, Ohio, are the manufacturers, while Westinghouse Electric Co. motors are used for the drive.

AUTOMATIC VERTICAL TURRET.

Among the new designs of metal working machinery, our attention has been called to the new automatic turret machine, known as model F, just completed by the Turner Machine Co. in their Danbury, Conn., plant. This machine is designed for heavy duty, and is intended to complete a series of operations without shifting the position of the work or changing the tools. Each spindle carries a different tool which successively and automatically registers in precisely the same position. The automatic feature is neither cumbersome nor complicated, so that the machine can be operated by the average workman at full capacity and with extreme accuracy.

The column and base are cast integral, the column being rectangular, internally ribbed and cross-braced. The turret is vertical, revolving horizontally; the rotation being automatic. When the operation returns the spindle to its full height, the turret automatically indexes to the next spindle. The detents are adjustable, both for wear and accuracy, and are made of special chrome-vanadium ball race steel, heat treated. As the detents are located further from the center of the turret than are the working tools or spindles, the most extreme accuracy is obtained and maintained. Spindles are of heat treated nickel steel, with guaranteed elastic limit of 90,000 lbs. per square inch, ground their entire length.



TURNER AUTOMATIC VERTICAL TURRET

The spindles and their driving gears on the vertical shaft are of chrome nickel steel, heat treated, while F. & S.

TOOL CHEST NO. 766.

ball thrust bearings are under the spindle gears on top of the turret, and at the bottom of the spindles to take the upward thrust of the tools. The feed mechanism is driven from the vertical shaft, which drives the spindle. Feed may be engaged and disengaged without stopping the machine, an automatic trip being provided to throw the feed at a pre-determined travel of the spindle, which may be set as desired.

The feed gears are enclosed in a dust-proof case, and provide four feed changes, with direct drive on the coarser feed. The feed gears in connection with the two different spindle speeds give a possibility of eighty feed changes for the machine. The feed is actuated by helical gears, resembling worms and worm gears. The worms are made of chrome nickel steel, heat treated; while the worm gears are special hard gear bronze. The spur gears for the gear changes are of stub tooth form, cut by Fellows' process. The feed gears do not run except when in use. Three sets of worms and worm gears are used in the feed. The first two sets run at higher speeds and lower pressure than the final sets, and the thrust of the first two is taken by multiple washers and the last by a ball thrust.

The spindles may be fed, either by the hand lever or hand wheel. The latter is more sensitive, thereby adapting the machine for profiling and similar milling jobs. Inactive spindles are positively locked in their extreme upper position, and as each spindle is automatically swung into its working position its positive lock releases, and its weight is carried by an adjustable spring; one spring only being used for all of the spindles. The spindle projects approximately $1\frac{1}{2}$ ins. beyond the sleeve, a ball thrust bearing being interposed between the nose of the spindle and the end of the sleeve, while the bearing is packed with grease and surrounded by a dust excluding brass collar. The sleeve is 12 11-16 ins. long, and the spindle has a bearing within the sleeve of four inches at each end, with an oil chamber in the center. The upper end of the spindle is guided in the turret, the turret being 17 ins. long. This method of supporting the spindles so close to the nose, together with the long bearings placed far apart gives exceptionally rigid support and guidance. The absence of universal joints and consequent intermittent motion and angular pressure, obviates much wear, chatter and breaking of tools. Another feature which makes this machine, even though massive and powerful in construction, suitable for small or delicate tools, such as small drills, taps, etc., is that each tool may have its own individual feed which may be hand fed if desired.

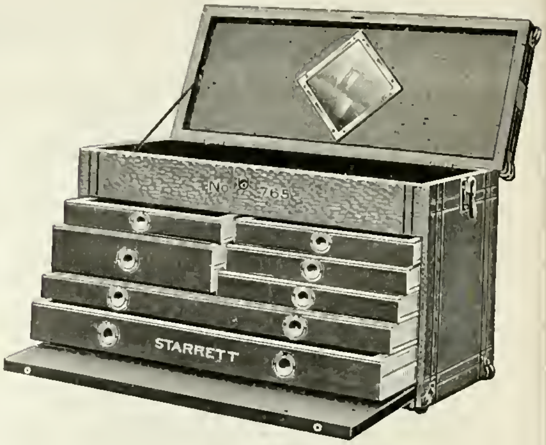
The back gears are operated by the Carlyle & Johnson friction clutch, and may be rocked out of engagement like

TOOL CHEST NO. 767.

the back gears of a lathe when not in use. All gears except bevels, are cut by Fellows' process, the bevels being cut by the Bilgram process, with teeth of spiral form. This construction insures silence and smoothness of drive.

TOOL CHEST NO. 765.

The tapping gears operate the reverse of the tap or die at a ratio of one and six tenths to one, and may be disengaged by means of an intermediate gear when not in use. The back gears and



TOOL CHEST NO. 765.

tapping gears may be engaged and disengaged without stopping the machine, and positively without shock. All controls are within easy reach of the operator.

The slotted table is strong and well ribbed and has a working surface of 18 in. x 23 in.; the oil channel being of ample dimensions to prevent its overflowing. A gear-driven oil pump with large oil tank and a separate flexible oil supply pipe, furnish oil to the cutting tools. The table is separate from the knee, and has a three-point support thereon. All shaft bearings are renewable, special bronze bushings, and lubrication is wherever possible by compression grease cups, while all gears are encased to meet safety requirements.

To change the machine from one job to another, it is only necessary to change the tools for the successive operations to be performed, and place the proper jigs to be used on the table. Each tool comes to the same center automatically, until the successive operations are completed.

TOOL CHESTS.

The L. S. Starrett Co., well-known makers of fine mechanical tools, have put on the market three styles of chests as illustrated.

No. 765, the finest grade made, is covered with best leatherette with highly polished solid mahogany drawer fronts.

The drawers and till are lined bottom and side with best grade of green felt with special patent locking arrangement. The corners are raised and there is a nickel-plated mirror in the top of the till. The outside dimensions are 20 5-16 inches long, $7\frac{5}{8}$ inches wide, and $12\frac{3}{8}$ inches high, while the shipping weight 17 pounds. The till is three in-

ches deep, and the large drawers $18\frac{1}{4}$ inches by 6 inches.

Two lower priced chests, Nos. 766 and 767 are similarly constructed, but of different material. No. 766 is made of best grade quarter-sawed oak with five top drawers lined with green felt. The outside dimensions are 17 inches long, $7\frac{5}{8}$ inches wide, $12\frac{3}{8}$ inches high, with shipping weight of 16 pounds.

No. 767 is made of hazelwood thoroughly kiln dried. The finish is satiny walnut. This chest is light and strong, and conveniently arranged; its outside dimensions being 17 inches long, $7\frac{5}{8}$ inches wide, and $10\frac{3}{4}$ inches high. The shipping weight is only 13 pounds.

VERTICAL METAL BAND SAWING MACHINE.

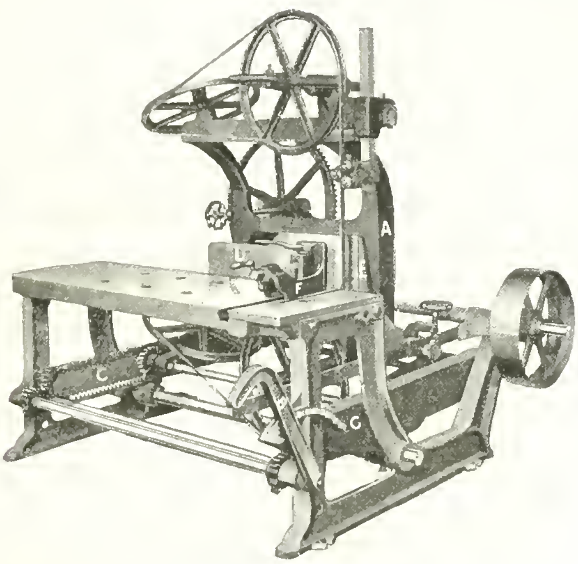
For cutting metal to various lengths and at any desired angle, M. E. Shinn & Co., Chicago, Ill., have developed a new type of vertical gravity feed metal band saw machine, which is entirely automatic. One of the features about it is the way in which the non-cutting part of the blade is returned so as not to interfere with the material being cut.

As will be noticed from the accompanying cut, the machine is designed so that there is nothing to interfere with the metal irrespective of the length that is being cut. By means of an adjustable radial back, and the vise which operates in a groove in the table, the material can be cut at any desired angle. By removing a cap screw, the lug at the right of the radial back can be removed so that the table is entirely clear and any length can be sawed longitudinally, there being a clearance of 8 in. between the saw and arbor frame.

The saw arbor is mounted upon four ball bearing wheels, two of which have gears attached. These travel in channels to guide the saw arbor in alignment. The inclination of the plane of the trackway is altered by the operating lever at the right side of the machine below the table which regulates the feed. By this arrangement the cutting part of the saw is kept in a vertical position during the entire length of the cut, and the gravity feed is constant throughout the operation and can be accelerated or retarded by the operating lever according to the size of the material being cut.

The non-cutting part of the blade is returned by passing over wheels in such a way as to obviate any interference with the material being cut. At the same time the cutting edge is left perfectly vertical and free from twist, while passing over the two wheels which carry the working part of the saw. In this way it is emphasized that the saw runs straight in the line of the cut and accuracy in cutting and longer life to the saw band are insured.

The action of the saw is entirely automatic, as after the cut is completed the saw is brought to a stop so that it can be adjusted to any width of material. This stop operates a clutch attached to the drive pulley on the machine and can be adjusted to suit any width of the material, the saw having a cutting capacity up to 11 x 12 in. The saw used is $15\frac{1}{2}$ ft. long, $\frac{5}{8}$ in. wide and 0.0312 in. thick. At ordinary operating speed this machine will cut cold rolled shafting $2\frac{1}{2}$ in. in diameter in 3 min., or 6 in. in 23 min.



METAL BAND SAW MACHINE.

The floor space occupied by the machine is 14 sq. ft., measuring 45 x 45 in. The table is 42 in. long and is 18 in. from the floor. The crated shipping weight is 450 lb.

While the machine illustrated is designed for belt drive, back geared motor drive can be supplied if desired.

CANADIAN TRADE.

A statement of Canadian trade for the last fiscal year has just been issued by the Trade and Commerce Department. Total trade in merchandise for the year was \$1,073,766,098, an increase of \$26,697,554 over the preceding fiscal year. Imports totaled \$618,328,874, a decrease of \$51,671,315, while exports totaled \$455,437,224, an increase of \$78,368,869.

The net increase in trade for the year was due to the big gain in exports of agricultural products, animal produce and manufactured products, particularly during the autumn months. Since then there has been a considerable falling off both in imports and exports. The total exports of agricultural products for the year was \$198,220,029, an increase of \$48,074,368, or nearly thirty per cent. Exports of animal product totaled \$53,349,119, an increase of \$8,564,526, and exports of manufactures totaled \$57,443,452, an increase of \$13,750,644.

There was a much greater movement of coin and bullion during the year than during 1912-13. Imports of coin and bullion totaled \$15,325,305, an increase of \$9,807,326. Exports of coin and bullion totaled \$23,560,704, an increase of \$7,397,002. In the liquidation of balances, Canada thus sent out of the country \$8,325,399 more of gold and bullion than was brought in.

Trade with the United Kingdom showed a net increase of \$37,634,098. Trade with the United States showed a net increase of nearly three millions. With the British West Indies, including Bermuda, despite the recent reciprocal trade agreement, there was a net falling off in trade of \$1,620,287. From nearly every country imports decreased, while to every country, except the Argentine Republic, exports increased.

From the United Kingdom, Canada took last year imports valued at \$131,942,763, or \$6,706,666 less than the preceding year. Canadian exports to the United Kingdom totaled \$222,322,766, a gain of \$44,340,764. Imports from the United States last year totaled \$410,786,091, a decrease of \$30,369,764. Exports to the United States totaled \$200,459,373, a gain of \$33,348,991.

Statistics of trade with the West Indies show imports of \$4,354,849, a decrease of \$1,662,281; an export of \$4,770,200, a gain of \$41,998.

W. C. Brennan has been appointed works commissioner of Fort William, Ont., in charge of construction and maintenance of roads and sewer work, etc. Mr. Brennan was formerly secretary of the Department of Public Works at Hamilton, Ont., and has held similar positions in various parts of Canada for the past twenty four years.

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A weekly newspaper devoted to the machinery and manufacturing interests, with special reference to machine tool improvement and development, machine shop methods, devices and systems relative to efficiency and economy of production.

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Subscribers who are not receiving their paper regularly will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. XI. JUNE 25, 1914 No. 26

PRINCIPAL CONTENTS.

SINCERITY ADVERTISING.

FROM June 21 to 25, the Associated Advertising Clubs of America held their annual convention in Toronto. Not only were new records established in point of members attending as compared with kindred gatherings on Canadian soil, but there was borne in upon our people with a renewed forcefulness, the fact that public mediums, whereby the products of the farm, the mill and the factory are brought vividly to their notice, are neither superfluous for their intelligence development nor given to misrepresentation or exaggeration. Relative to the foregoing, subscribers to **Canadian Machinery** are invited to take a keener interest in and develop the habit of studying its advertising as well as its editorial, the combination feature producing more immediate and greater returns.

The old order changeth, and although our policy has always been truth and sincerity at any cost, the practice has been far from universal. While appreciating therefore the general advance now being made, we simply reiterate former appeals to our readers to appropriate to themselves the benefits derivable from closely scrutinizing the offerings of those who advertise with us.

IMPATIENT AMBITION.

THE ambition to achieve or attain to something beyond our personal status or even that of our ancestry or our fellows is of course laudable; the danger lies, however, in the attitude or temperament we bring to bear on the accomplishment of our ideal. It is easily apparent or should be to even a superficial observer that nine out of every ten individuals, to take a moderate estimate, wreck their prospects through impatience.

The exceptional capacity which we attribute to many of our most successful men in every sphere is to a large extent an erroneous inference, being based more or less on their standing after achievement without regard to the details of the individual career leading thereto.

We are disposed to aver that there is little difference in the ability-to-succeed feature in individuals, but a huge difference in their patience make-up, and that this latter determines the ultimate result. Impatience is everywhere apparent, in business and out of it; the impatience to be boss, to shine and to get-rich-quick.

In our own country we need not cast around very much for examples of both. Our penetentiaries furnish a record of impatience that cannot be challenged, and if need be to emphasize this, there may be cited the case of one within its walls who typically exemplified his unrighteous desires in other directions by having great trees transferred and transplanted around his domicile instead of patiently waiting for young trees to grow.

Fortunately, we can also lay claim to shining examples of the virtue of patience, and in this respect, Lord Strathcona and Senator Cox, both recently deceased, appear preeminent. These both attained to considerable wealth, but neither through transcendent genius or rush methods.

There is a right and a wrong way, a true and a false attitude which can be adopted to compass an ambition, and the right and true generally go under when impatience is the driver. To-day, perhaps more than ever before, patience calls for cultivation.

UNIFORMITY OF BOILER INSPECTION.

A UNIFORM standard for boiler inspection to govern the whole of Canada, long urged by the departments of the more energetic provinces in this respect, seems at last to be in sight. A conference of inspectors representing all but two provinces is at present in session in Toronto and if the earnestness and good-will of the delegates shown in the preliminary meetings be an indication of possible results, we are sure much needed reform will be accomplished.

INDUSTRIAL NOTABILITIES--No. 40

JAMES DAVIDSON, president the Thomas Davidson Mfg. Co., Ltd., manufacturers of enamelled and stamped ware, Montreal, Toronto and Winnipeg; president Brome Lake Electric Co., Waterloo, Que.; president McDonald Car Buffer Co., Ltd., Montreal; president Shefford County Conservative Association; director Shefford Agricultural Society, was born at Montreal, Sept. 25, 1854, the son of Thomas and Mary (Ritchie) Davidson, of Scotland.

He was educated in the public schools, and entered the service of Thomas Davidson & Co. when quite young, working through its various departments until he is now at the head of the enterprise.

He is owner of Ayrmount Farm, Shefford County, Que., one of the finest farms in the Province, and makes it his special hobby. Mr. Davidson is Mayor

JAMES DAVIDSON

of Waterloo, Que.; Governor of Hospital, Sweetsburg, Que.; Governor Montreal General Hospital, and Governor Western Hospital, Montreal.

He married Alice M. Goodwill, daughter of William Goodwill, May 10, 1882, and has three sons and two daughters.

His clubs are St. James, Montreal Hunt, Beaconsfield Golf, Canada, Canadian, M.A.A.A., Montreal Art Association, British Empire Club (London, England), while his recreation, as already mentioned, is farming, raising fine stock, etc.

He is a Conservative in politics and an Anglican in religion.

Mr. Davidson resides at 292 Stanley Street, Montreal.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburgh		$13 65
Lake Superior, charcoal, Chicago		16 00
Ferro Nickel pig iron (Soo)		25 00
	Montreal.	**Toronto.**
Middlesboro, No. 3....	17 75	19 50
Carron, special	21 00	22 75
Carron, soft	21 00	22 75
Cleveland, No. 3	17 75	19 50
Clarence, No. 3	17 75	19 50
Glengarnock	20 00	21 75
Summerlee, No. 1	21 00	22 75
Summerlee, No. 3	20 00	21 75
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	18 75	18 10
Victoria, No. 2X.......	18 50	17 85
Victoria, No. 2 Plain ..	18 25	17 60

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto..	2.00
Steel bars, f.o.b., Toronto........	2.00
Common bar iron, f.o.b., Montreal..	2.05
Steel bars, f.o.b., Montreal........	2.00
Bessemer rails, heavy, at mill.....	1.25
Steel bars, Pittsburgh............	1.15
Twisted reinforcing bars	2.10
Tank plates, Pittsburgh..........	1.15
Beams and angles, Pittsburgh....	1.15
Steel hoops, Pittsburgh	1.35
F.O.B., Toronto Warehouse.	**Cents.**
Steel bars	2.10
Small shapes	2.30
Warehouse, Freight and Duty to Pay.	**Cents.**
Steel bars	1.60
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.
18 cents carload; 21 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ½ in. 100 lbs. ...	$2 20	$2 20
Heads, per 100 lbs.	2 55	2 55
Tank plates, 3-16 in.	2 50	2 50
Tubes, per 100 ft., 1 inch	9 50	9 00
" " 1¼ in.	9 50	9 00
" " 1½ "	9 50	9 00
" " 1¾ "	9 50	9 00
" " 2 "	8 75	8 75
" " 2½ "	11 15	11 50
" " 3 "	12 10	12 50
" " 3½ "	14 15	14 50
" " 4 "	18 00	18 00

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65 & 10%
Sq. & Hex. Head Cap Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45-10-10%
Flat & But. Head Cap Screws	40-10-10%
Finished Nuts up to 1 in. ..	75%
Finished Nuts over 1 in. ...	72%
Semi-Fin. Nuts up to 1 in. ..	72%
Semi-Fin. Nuts over 1 in. ..	72%
Studs	65%

NAILS AND SPIKES.

Standard steel wire nails, base..		$2 15
Cut nails	$2 60	2 65
Miscellaneous wire nails...		75 per cent.
Pressed spikes, ⅝ diam., 100 lbs.		2 85

BOLTS, NUTS AND SCREWS.

	Per Cent.
Stove bolts	80 & 7½
Coach and lag screws....	75
Plate washers	45
Machine bolts, ⅜ and less	65 & 10
Machine bolts, 7-16......	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes....	4¼ per lb. off
Nuts, Hexagon, all sizes..	4½ per lb. off
Fillister head	25 per cent.
Iron rivets	60, 10, 10 off
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.15
Wood screws, flathead, bright ......85, 10, 7½, 10, 10 p.c. off	
Wood screws, flathead, Brass ....75, 10, 7½, 10 p.c. off	
Wood screws, flathead, Bronze ....70, 10, 7½, 10 p.c. off	

BILLETS.

	Per Gross Ton
Bessemer billets, Pittsburgh ...	$20 00
Open hearth billets, Pittsburgh..	20 00
Forging billets, Pittsburgh.....	24 00
Wire rods, Pittsburgh..........	25 00

IRON PIPE FITTINGS.

Canadian malleable, 45 per cent.; cast iron, 65; standard bushings, 70; headers, 60; flanged unions, 60; malleable bushings, 65; nipples, 80; malleable, lipped unions, 65.

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$10 50	$11 00
Copper, crucible	12 00	12 25
Copper, unch-bled, heavy	11 50	11 50
Copper wire, unch'bled...	11 00	11 50
No. 1 machine compos'n	10 50	10 75
No. 1 compos'n turnings	9 00	9 00
No. 1 wrought iron	9 00	8 00
Heavy melting steel	7 00	8 50
No. 1 machin'y cast iron	12 00	12 00
New brass clippings	8 50	8 75
No. 1 brass turnings ...	7 25	7 50
Heavy lead	3 50	4 00
Tea lead	3 00	3 00
Scrap zinc	3 25	3 50

LIST PRICES OF W. I. PIPE

Standard. Nom. Diam.	Price. per ft.	Extra Strong. Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	...	.....
7 in	2.38	7 in	3.81	...	.....
8 in	2.50	8 in	4.34	...	.....
8 in	2.88	9 in	4.90	...	.....
9 in	3.45	10 in	5.48	...	.....
10 in	3.20	....	....	...	.....
10 in	3.50	....	....	...	.....
10 in	4.12	....	....	...	.....

W. I. PIPE DISCOUNTS.

The following are Toronto jobbers' discounts on pipe in effect, April 21, 1913:

	Buttweld		Lapweld	
Standard	Black	Gal.	Black	Gal.
¼, ⅜ in.	64	49	....	....
½ in.	69	58	....	....
¾ to 2 in. ...	73½	63½	....	....
2 in.	....	....	69½	59½
2½ to 4 in. ...	73	63	72	62
4½ to 6 in. ..	....	....	73	63
7, 8, 10 in.	....	....	67½	56½
X Strong P. E.				
¼, ⅜ in.	56½	46½	....	....
½ in.	64	54	....	....
¾ to 1½ in. ..	68	58	....	....
2 to 3 in.	69	59	....	....
2½ to 4 in. ...	....	....	66	56
4½ to 6 in. ..	....	....	68	59
7 to 8 in.	....	....	59	48
XX Strong P. E.				
½ to 2 in.	43	33	....	....
2½ to 4 in. ..	....	....	43	33

METALS.

	Montreal.	Toronto.
Lake copper, carload....	$15 75	$15 75
Electrolytic copper	15 50	15 50
Casting copper	15 25	15 45
Spelter	5 25	5 25
Tin	34 50	35 00
Lead	4 85	5 25
Antimony	8 50	8 50
Aluminum	20 00	19 00

BELTING—NO. 1 OAK TANNED.

Extra heavy, single and double	60%
Standard	60 & 10%
Cut leather lacing, No. 1	

BELTING RUBBER.

Standard	60%
Best grades	30%

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$2.75	$2.85
Canada plates, ordinary, 52 sheets	2.75	3.00
Canada plates, all bright	3.90	4.00
Apollo brand, $10\frac{3}{4}$ oz. (American)	4 50	4 40
Queen's Head, 28 B.W.G.	4 30	4 65
Fleur-de-Lis, 28 B.W.G.	4 10	4 45
Gorbal's Best, No. 28	4 40	4 65
Viking metal, No. 28	4.00	4.20

MISCELLANEOUS.

	Cents
Putty, 100 lb. drums	$2.60
Red dry lead, 5 cwt, casks, per cwt.	6.00
Glue, French medal, per lb.	0.10
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.21
Benzine, per gal.	0.20
Pure turpentine	0.65
Linseed oil, raw	0.65
Linseed oil, boiled	0.68
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	3.25
Pure Manila rope	0.15

COKE AND COAL.

Solvay Foundry Coke	$5.95
Connellsville Foundry Coke	5.20
Yough. Steam Lump Coal	3.88
Penn. Steam Lump Coal	3.68
Best Slack	3.05

All net ton f.o.b., Toronto.

Montreal, Que., June 22, 1914.—Though there has been little change in the volume of business handled at the present time, there is a disposition on the part of most of the supply houses to view the outlook with more favor than for some time past. Orders are none too plentiful, but several dealers report that they are figuring on contracts which will probably develop into something worth while very shortly. The Mond Nickel Co., of Coniston, Ont., have bought a lot of machinery in Montreal for installation in the new smelter.

Building work around the city is going on at a fairly satisfactory rate, both in the business districts and the residential sections. There is also a good deal of road-making under way by the civic authorities, much of it being asphalt or granite block pavement, for which a concrete base is required. This, together with private works by public utility companies, has increased the demand for concrete mixing machinery. There is not much improvement yet in railway construction work but a betterment is expected in the near future.

Metals.

There has been little change in the situation as regards metals. The market is still quiet, and inclines to weakness if anything. Little business is passing and no immediate improvement is looked for. London quotations are: Copper, spot, £61; future, £61 12 6; lead, £19 7 6; spelter, £21 7 6; iron, £51, 3.

Toronto, Ont., June 23, 1914.—Business conditions do not appear to be improving to any great extent, but there seems to be a more hopeful feeling based on continued favorable reports from the West. The crops will always be an important factor in the situation, but it does not necessarily follow that a record crop, if such materializes, will suddenly develop trade to the condition of a boom. When an improvement does begin, the process will be gradual to allow for an adjustment of conditions generally.

Industrial companies so far this year have made an exceptionally poor showing; without exception decreased profits being indicated as a result of the general depression, and the reports that are to follow do not promise to be much better. The financial stringency which became general some months ago is not now so great, but it has left in its trail a spirit of caution, which is perhaps responsible as much as anything else for the continuance of the depression. When sufficient time has elapsed to eradicate the effect of recent troubles there should be a marked improvement. Signs are not wanting that better business is anticipated this fall.

Preliminary operations in connection with the local harbor improvements are now well under way. A large number of men are being employed by the Harbor Commission and the contractors, and a considerable amount of equipment is being used. A large amount of money will be spent this year on the work. This will benefit trade locally. The North Toronto drainage scheme, involving the expenditure of over four million dollars, has been passed by the city council.

Steel Market.

There has been some disappointment expressed that the spring failed to bring about the revival in the steel trade that was looked for. There are, however, prospects of better times, and a moderate improvement may be expected in the near future. The first shipment of rails for the C.N.R. will be dispatched from Sidney, N.S., to British Columbia this week. This is part of the recent order, the balance will keep the mills going until the fall. Another sign of better times coming is the blowing in of a furnace by the Steel Company of Canada at their Hamilton, Ont., plant, last Sunday. This will be followed by a similar event next Sunday, when the company will blow in another furnace at the same plant. The company report that prospects are looking much brighter. The operation of these furnaces and mills will mean the employment of between four and five hundred men. It is considered probable that the railroads will soon have to be placing orders for equipment, as they have been out of the market for nearly twelve months.

Advices from the United States indicate that there is a buying movement in progress, but reports differ as to the extent. The railroads have been buying more freely of both rails and equipment. Prices remain at the same level, however, and no change is anticipated in the very immediate future.

Pig Iron

The pig iron market shows no improvement, but it will no doubt respond to the revival that seems to have started in the steel trade. Some regular foundrymen are moderate buyers, but such large consumers as railways and car shops, etc., are practically out of the market for the moment. The season's importations from Great Britain are much below the average.

Machine Tools.

Little can be said with regard to the machine tool market; conditions show very little variation. From general indications, no material improvement appears to be anticipated for several months. The Consumers Gas Co. have recently purchased a large planer and shaper from John Bertram & Sons Co., Dundas, Ont.

Metals.

There has been no change in prices in the local metal markets during the week. Consumers continue to buy in small lots. The outlook, however, is brighter.

Winnipeg, Man., June 20, 1914.—Geo. Harrison of the Saskatchewan Bridge & Iron Works, passed through the city this week on his way to Toronto and Chicago, to make arrangements for completing the plant which this company is now erecting in Medicine Hat. The parent plant is in Moose Jaw. A year ago the city of Medicine Hat gave this company a site of 50 acres, and the structural work on the new plant has already been completed. It will now be roofed in, and equipment purchased. When financial arrangements have been made, it

is believed that this company will be in the market for considerable machinery.

Several new propositions are under way in and out of the city, though little in the way of machine tool business is being done. The Oribo Mfg. Co., 233 Spadina Ave., Winnipeg, who recently started a plant for the manufacture of stove piping and metal garages, has secured a permit for the erection of a new factory costing $8,500. If equipment is required, it will be in the nature of sheet metal working machinery. John Brockest is president.

New Plants.

Another company building a plant in this city, who will no doubt require considerable transmission equipment, though not until September, is the Sunset Manufacturing Co., who make bags, and are connected with one of the large milling concerns. They are already at work on the foundations.

The contract for a branch factory will shortly be let by the J. R. Watkins Medical Co., Winona, Minn. This plant will be erected in Winnipeg, near the C. P. R. subway, and will cost in the neighborhood of $75,000. The building will be 100 feet square, of modern fireproof construction, and will be of sufficient strength to carry four more storeys when needed. Work will be rushed to have it completed before the arrival of cold weather.

Metals, Ltd., Calgary, have secured a permit for the erection of a warehouse on Fourth street, Edmonton. Warehouses, costing in the neighborhood of $75,000 are being erected in Winnipeg by Martin, Bole & Wynn, at the corner of McDermott and Lydia, and by Ames, Holden & McCready, at the corner of McDermott and Adelaide.

The Economy Foundry Co., who have offices at 619 Somerset Block, and a foundry at Portage la Prairie, Man., state that they are being kept very busy with jobbing work. Their usual line is manholes, gratings, and specialties of that nature. Considerable business is being done by local jobbers in threshers' supplies in view of the coming harvest. These include brass valves, injectors, steam gauges, pipe fittings, small tank pumps, sheet packing and piston packing, lubricating oils and greases, belting, etc.

Crop Reports Good.

Recent crop reports are of the most favorable character. Until a few weeks ago, Southern Saskatchewan and Alberta had had no rain, and their crop was in great danger. Business in that district as a result, was at a very low ebb. Rain has since fallen, and the rush of business expected about the time harvesting arrives is expected to eclipse that of 1912, when everybody, especially hardwaremen, were found without stocks.

The representative of a large American machinery firm, who was in the city last week, said busines looked better to him here, than anywhere in the West. He said the change was very perceptible as soon as he crossed the Rockies. He gave a gloomy description of trade conditions in Vancouver, and said that if it were not for the amount of Government work going on in British Columbia, things would be even worse.

Railway Work.

It is stated that the C.N.R. will shortly start work on the completion of its line from Calgary to MacLeod, and will erect a large roundhouse at the former city. Of the line from Calgary to Edmonton, 28 miles has already been graded, and the company intends to complete it this year if possible.

Quite a little business has been secured by a local house this week from Western blacksmiths. Many of them are buying power hammers. The Stuart Machinery Co., this week secured an order from the Winnipeg Steel Granary & Culvert Co., for a 16-foot draw bench.

Price of Nails.

Following an increase of 15c per keg in the price of nails made by Eastern manufacturers, local jobbers are considering raising the price west of the Lakes. The change, however, at this date had not been made.

PROBLEM OF COAL STORAGE.

THE problem of coal storage is an important one to every manufacturer. In order to safeguard the continuity of power supply when there is a shortage of coal due to strikes or other causes, a reserve supply of fuel must be kept. It is, however, by no means an easy matter to store coal in a satisfactoy manner, because even if means are taken to avoid the obvious forms of trouble such as spontaneous combustion, there is always—when coal is exposed to air — a slow oxidation which tends to deteriorate the calorific value of the fuel. A good deal of attention has been paid to this matter within recent times, and one or two notes on the subject may be of interest.

U.S. Bureau of Mines Investigation.

The United States Bureau of Mines recently investigated the deterioration of various kinds of coal under storage, and it was found that, while several coals evolved methane in large volumes, especially in the early period after mining the coal, the gas evolved in one year from this cause means a maximum loss in calorific value of 0.16 per cent., this loss covering a period of one year from the time the coal was mined. The Navy Department tests show a loss of less than 1 per cent. in a year on New River coal weathering in the open; and Pocahontas coal in a 120-ton pile on the Isthmus of Panama lost less than 0.4 per cent. during one year's outdoor weathering. Pittsburgh gas coal suffered no loss whatever during six months' outdoor weathering. Wyoming coal, however, lost 5.3 per cent. during two years and nine months, 3.5 per cent. of which was lost in the first three months. For a distance of from 12 to 18 in. from the surface there was bad slackening and crumbling of the lumps. Illinois coal as tested by Prof. Parr, of the University of Illinois, lost 1 to 3 per cent. in a year with slackening and crumbling.

The average value therefore appears to be a loss of 1 to 3 per cent. of heating value in one year, a large percentage of this loss occurring within from three to six months after the coal has been placed in storage.

Spontaneous Combustion Danger.

The danger which is to be most carefully avoided in connection with coal storage is the more rapid form of oxidation known as spontaneous combustion. Mr. Barker names the causes of spontaneous combustion as the escape of inflammable gases from fresh coal surfaces, the absorption of oxygen from the air with the production of heating, the presence of fine coal which brings large surfaces into contact with the air and so accelerates the oxidation of the whole mass, the presence of an excessive amount of moisture (especially if the coal under storage becomes alternately wet and dry), and in some cases the presence of external causes of heating even if these are very moderate in amount.

As regards the escape of gases, he states that the results of experiments in freshly mined coal show that the loss of gases is about equal to the volume of coal, and the heating value of such gases amounts to 0.1 or 0.2 of the heating value of the coal. The point about this is not the actual calorific value which is lost, but the danger of explosion attending on the escape of such inflammable gases; while the evolution of heat accompanying oxidation is one of the great causes of danger of spontaneous combustion in coal piles. Heat from steam pipes, boiler and walls also tend to the ignition of the mass.

The above notes give only in brief outline the general features of a problem which is of very great interest to all manufacturers, but the suggestions may form a sufficient starting point for investigations to be carried out with the object of reducing the large margin of loss and danger which at the present time exists in many coal storage schemes.—Engineering Review.

ASSOCIATION AND PERSONAL

A Weekly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Machinery Circles

G. M. Bosworth, vice-president of the C.P.R., has returned by the Alsatian from England.

R. H. Skelton, manager of the Ontario Sewer Pipe Co., Mimico, Ont., died on June 10, aged 45.

Sir Max Aitken and **H. S. Holt** have resigned from the board of the Canada Car & Foundry Co.

Alfred W. Smithers, chairman of the Grand Trunk Board, has arrived in London from Canada.

R. G. Reid, president of the Reid Newfoundland Co., has returned from abroad on the Calgarian.

Major J. A. Benyon, assistant agent-general for Quebec Province in London, died there on June 16.

Dr. Colner, formerly professor at McGill, has been appointed to the chair of engineering at London University.

Arch. Currie, city engineer of Ottawa, has returned from Atlantic City, where he has been recovering from a nervous breakdown.

Capt. H. St. George Lindsay has retired as wreck commissioner, to become superintendent of pilots for and below the Harbor of Quebec.

F. A. Skelton, secretary-treasurer of the Canadian Car and Foundry Co., Ltd., was elected a member of the board at a meeting of the directors on June 15.

Capt. T. Bourassa, deputy harbor master at Montreal, will be promoted to the full position of harbor master of that port in place of Capt. Demers.

T. E. Dalrymple, vice-president of the G. T. R., and George Smithers, of Burnett & Co., brokers, have been appointed directors of the Canada Steamship Lines.

W. D. B. Motter, Jr., who has been manager of the Canada Iron Mines, Ltd., Trenton, Ont., has been appointed manager of the Benson Mines Co., Benson Mines, N.Y.

Z. A. Hall, of the Hall Foundry Co., Hespeler, Ont., has been nominated by the Conservative convention as candidate for South Waterloo, at the approaching Provincial elections.

C. J. Brittain, manager of the Winnipeg branch of the Canadian Fairbanks-Morse Co., left hurriedly for Moose Jaw, Thursday, on receipt of news that his brother had died in that city.

Wm. C. Rowse, B.Sc., M.E., has been appointed professor of mechanical engineering at the University of Manitoba, Winnipeg. Prof. Rowse is a graduate of Purdue University.

Lieut. James F. Symons, R.N.R., who for the past year and a half has acted as assistant harbor master at Montreal, Que., is promoted to succeed Capt Bourassa, as deputy harbor master of that port.

James Frater Taylor, president Lake Superior Corporation, was in Toronto this week, doubtless with a view to getting some of the orders going for rails. The Algoma plant is doing fairly well at present.

Captain Carey, of the C.P.R. steamship lines, has retired from the service after 51 years at sea. Captain Carey was the first commander of the Empress of Ireland, but after one season relinquished the command, returning to the Lake Erie, known now as the Tyrolia.

John H. Wynne has been made manager of the Montreal Locomotive Works, Ltd., Dominion Express Building, Montreal, Que., succeeding Percy Webb, who after years of service with this and the American Locomotive Company has retired.

Professor Robert Crawford died recently at Ballyshannon, Ireland. Professor Crawford was an eminent engineer who carried out several important schemes in Canada and one time filled the chair of Engineering at McGill University, Montreal.

James G. Ross, accountant, and E. Belanger, civil engineer, both of Montreal, have been delegated by the City of Montreal, to make an examination of the plant and books of the Montreal Water & Power Co., and to submit a report to the Board of Control. This is in connection with the proposed purchase of the company's plant by the city.

G. A. McCarthy has been appointed to succeed G. W. Power as engineer of the railway and bridges section of the civic works department, Toronto. Mr. McCarthy has been at various times connected with the engineering departments of the T. & N.O.R., C.P.R., and Algoma Central Railway, while last year he was engineer on the Feather River power development in California. Mr. McCarthy will assume his duties on June 30.

George H. Flood, of St. John, N.B., who has recently been promoted as purchasing agent of the Marine and Fisheries Department, at Ottawa, was the recipient recently of an address, a gold watch and a traveling companion from his friends and colleagues at the customs house. Besides the office staff there were several captains and officers of ships of the service at the presentation, which was presided over by Captain Elkin.

Frank O. White, a Victorian of many years' experience in the shipping business has just been appointed Lloyd's agent at Victoria, B.C. He succeeds John Waterhouse, who has acted in the capacity for some time past. The agency here comes under control of C. Gardner Johnson, Vancouver, who is the British Columbian representative for the Great Britain concern. Victoria is one of Lloyd's most important stations in Canada.

M. M. Reynolds, for six years vice-president of the Grand Trunk, and later the Grand Trunk Pacific and Central Vermont Railways, passed away at an early hour on June 17, at Old Point Comfort, Virginia, from Bright's Disease. Mr. Reynold's health broke down early this spring, and on the advice of his doctors he left for Old Point Comfort about a month ago. Mr. Reynolds was born in Syracuse, N.Y., in 1859. He entered the service of the G. T. R. in 1908, as fifth vice-president, and was appointed second vice-president in 1912.

The Ideal Furniture Co., Ltd., of Vancouver, have been incorporated at Victoria, B.C., with a capital of $20,000.

The Engineers' Supply Co. have removed their offices from 139 Market St., E., to 123 Bannatyne Ave., E., Winnipeg. They carry engine packings, belting, and steam specialties.

The John Galt Engineering Co., of Calgary, have been instructed by the town of Wainwright, Sask., to prepare plans, etc., for the proposed drainage system.

The International Supply Co., of Medicine Hat has been awarded contracts amounting to $70,000 by various companies in that district for drill work and repairs.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Hespeler, Ont.—It is reported that the Canada Machinery Corporation's plant will be opened up shortly.

The Canada Wire and Cable Co., Ltd., of Toronto, has been granted permission to increase its capital to $3,000,000.

Saskatoon, Sask.—Plans are being prepared for the extension to the power house building, and are being drafted so that the proposed addition will be a complete unit, and will permit of further additions being made in the future. The addition will be built on the north side of the present building, and will be about 60 feet wide, running from the sidewalk line to the rear of the building.

St. John, N.B.—Tenders for cast iron pipes for the water and sewerage department have been opened. Bids were received from D. Y. Stewart & Co.; U.S. Cast Iron Pipe and Foundry Co.; T. McAvity & Sons, Ltd.; Vroom & Arnold, John Birch & Co., Ltd.; Canadian Fairbanks-Morse Co., Ltd.; Francis Hankin & Co.; B. & S. H. Thompson & Co., Ltd.; Drummond, McCall & Co.; Watson, Jack & Co., and Singleton, Dun & Co. The tender of John Coates & Co. was not accepted, as no deposit was enclosed.

Electrical

Salmon Arm, B.C.—A by-law will be voted on in the near future to erect electric light and power transmission lines.

Sherbrooke, Que.—The Gas and Electric Committee have been authorized to purchase six or twelve standard poles for street lighting as a test for the proposed lighting of the main streets, and also to take the necessary steps to have estimates and specifications made for the underground conduit or wiring for such lighting and to be ready to install same at the same time as the streets will be fixed up by the Road Department.

Windsor, Ont.—The city council of Windsor will ask the Ontario Hydro-Electric Commission to report on cost of construction, equipment and operation of a system of electric railways to commence at a point in the township of Sandwich West, near the town of Ojibway, and connect by one or more routes the town of Sandwich, city of Windsor, town of Walkerville, town of Ford, townships of Sandwich East and Maidstone, and villages of St. Claire and Belle River.

Simcoe, Ont.—A by-law will be voted on by the ratepayers on June 26 to authorize the raising of $40,000 for electrical equipment for the distribution of power from the Hydro-Electric Commission service.

General Industrial

Vancouver, B.C.—A creamery and ice cream plant may be established at Grand Forks.

Danville, Que.—J. L. Goodhue & Co. are enlarging their plant at the tannery by adding to the buildings already erected.

Lockwood, Sask.—The elevator of the Maple Leaf Elevator Co. has been destroyed by fire. The loss is estimated at $7,000.

Windsor, Ont.—A by-law will be voted on to grant a site to Salzenstein Bros., who propose to build an abattoir. J. C. Pennington, Windsor, architect.

Lachute, Que.—The Lachute Knitting Co. will immediately commence rebuilding their plant which was recently destroyed by fire.

St. John, N.B.—The Board of Trade has received inquiries from a brick-making firm regarding opportunities for the establishment of a brick-making plant here. The firm state that they would employ 500 men to start and they have already had the offer of free sites in two Canadian cities. They ask what facilities over and above those of manufacture could be obtained here. The letter has been referred to the council for consultation with the civi authorities.

Ottawa, Ont. — A new million-dollar transfer elevator will be built in Vancouver by the Dominion Government. The elevator is to be built on a site situated on the Government dock in Vancouver harbor. It will furnish a facility much needed by the Pacific coast, but especially valuable in view of the opening of the Panama Canal. Tenders will be called for the structure within a couple of months. It is expected the cost of the elevator will be between $750,000 and $1,000,000.

Municipal

St. John, N.B.—The council are considering the question of installing an incinerator.

Ottawa, Ont.—The town council of Gatineau Point are considering the purchase of a fire engine.

Montreal, Que.—The Board of Control have approved of an expenditure of $13,900 for new water mains.

St. John, N.B.—The city council has authorized the purchase of a motor truck for the works department at a cost of $5,000.

Brandon, Man.—The Brandon Gas & Power Co. will be in the market later on in the season for cast iron pipe for gas mains.

Tillsonburg, Ont.—A by-law will be voted on by the ratepayers on June 26 in connection with the Oxford Linen Mills.

Campbellford, Ont.—At a recent meeting of the Water and Light Commission it was decided to purchase an additional 500 feet of hose for fire protection purposes.

Pembroke, Ont.—Plans are in progress for extensions to the waterworks system. The town council will receive prices on cast iron pipe, specials, hydrants and valves.

St. John, N.B.—The council have decided to purchase a motor-driven aerial truck or motor pumping engine for the fire department. The estimated cost is $12,000.

Vancouver, B.C.—Contracts for brass goods have been recommended to be let to the Mueller Co.; for hydrants to the Terminal City Iron Works; for valves to the Crane Co.; for meters to the Buffalo Meter Co.

Ottawa, Ont.—The city council has decided to purchase an asphalt surface heater, fire wagons, tar pots, dampers, also a drain-cleaning apparatus for the works department. Tenders will be called shortly.

Sherbrooke, Que.—A request by the Gas and Electric Department for an extra appropriation of $16,000 for the purchase of 2,000 electric meters to replace the controllers has been referred to the Finance Committee.

The Ford-Smith Machine Company

Pulley may be covered over with a Special Cap and Machine driven from below if desired. 20-in. Heavy Type, Self-Oiling Polisher

High-Grade Polishing Machines

We build the type shown here in sizes for 16" and 20" wheels, and a lighter type for wheels from 6" up to 18", also self-oiling.

Besides these we manufacture **Double Spindle Machines**, Overhung Machines, etc., and can supply any of above belt or direct motor drive. **You ought to have our latest catalog and further get acquainted with Ford-Smith service, both in regard to delivery and quality machines.**

WE MANUFACTURE MOST EVERYTHING IN THE GRINDER LINE.

The Ford-Smith Machine Co., - Hamilton, Ontario

Heat and Friction will be killed and all Ball-Bearing Troubles reduced to a minimum if you use these

Asbestos Lubricants

That you'll save much money through their use is a certainty!

Giving us the opportunity of putting you in touch with users is the first step toward greater economy.

Write for list of users now.

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Montreal Office: 30 St. Francois Xavier St.

ASBESTOLENE

A lubricant that is manufactured specially to meet the growing demand for a high-grade friction-eliminating substance, one that prevents heat due to friction, and reduces that friction itself to the minimum.

AXOLENE

Is the most economical grease. Where there is a demand for a heavier-bodied lubricant, this meets the requirements perfectly. It does not become hardened with age, it is not affected by atmospheric changes. It meets with general favor as a lubricant where slower speeds are to be encountered.

SPEDOLENE

Designed especially for use in connection with Transmissions, Differentials, Universal Joints, Bearings, and all worn gears in Motor Cars or Trucks. Where rapidly moving parts are to be satisfactorily lubricated, this cannot be equalled.

Sherbrooke, Que.—The Gas and Electric Department have been authorized to engage a consulting engineer to prepare plans and specifications jointly with the city engineer for the construction of a concrete dam at the city's electric plant on the Magog River.

Orillia, Ont.—The by-law which was voted on last Thursday for the raising of $85,000 to install a filtration plant passed by a majority of 66. The ratepayers also voted to install a water main in the Moffatt Farm and also to protect that district and Cedar Island from fire. Over 600 ratepayers turned out to the polls, 259 of whom voted against the by-laws.

Vernon, B.C.—A letter from the Provincial Board of Health has been received by the city engineers, with reference to the proposed changes and additions to the city's sewage disposal works, which requires the city to construct at once a chlorination tank in which the present outflow can be treated during the time that the permanent plant is being erected. The tank will cost about $620.

Vernon, B.C.—Plans and specifications for the complete new disposal works were recently submitted to the City Council by Cummins and Agnew, and were referred to the Health Committee for approval. After being approved by the council, the plans will have to be sent to Victoria to obtain the sanction of the Provincial health department before the construction work can be begun.

Building Notes

Toronto, Ont.—Charles Tugman will erect a $40,000 building at 288 and 290 Yonge Street.

Oakville, Ont.—A post office and armory will probably be built here at an estimated cost of $40,000.

Camrose, Alta. — The Imperial Oil Co., will build a warehouse here. Jas. A. Boyd, of Edmonton, is the district manager for the company.

London, Ont.—It is reported that the International Harvester Co. is considering the purchase of a site for a larger warehouse and assembling plant in this city.

Toronto, Ont.—S. Rosenblat has plans out for a four-storey warehouse which he intends to build on the property he purchased about a year ago in McCaul street. The cost will run about $35,000.

Prince Rupert, B.C.—Tenders are being called until July 6 for the erection of a post office at an estimated cost of $100,000. R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Hamilton, Ont.—The proposed extensions to the General Hospital will cost about $100,000. The plans have been prepared.

Ingersoll Ont. — An armory will be erected here at a cost of $50,000. Tenders will be called shortly.

Montreal, Que.—Tenders for the erection of the $100,000 factory for the Tuckett Tobacco Co. are being called. The architects are Stewart & Witton, Hamilton, and Brown & Vallance, Montreal.

Redcliff, Alta.—The burgesses have voted unanimously in favor of the $15,000 by-law providing for the enlargement of the town hall and the building of a new fire hall. It is hoped to get this work started as soon as possible.

Toronto, Ont.—A permit has been issued from the City Architect's Department for a $100,000 six-storey warehouse to be built on the north-west corner of Yonge and Albert streets for the Misses M. E. and M. McCarthy.

Toronto, Ont.—The Board of Control has granted to the Scotland Woolen Mills Co., a permit for a four-storey building to be erected on Simcoe street near Queen. The new building will consist of a warehouse and factory.

Toronto, Ont.—A six-storey warehouse will be erected at 256-260 Richmond street, west, by David Dunkelman. The building will be of steel, brick and stone and will cost $55,000. A building permit was issued by the city architect's department on June 11.

Regina, Sask.—An application for a permit for the new Woolworth store on Eleventh avenue, has been made at the building inspector's office. The building is to be completed in six weeks' time at a cost of $12,000 by Thos. Barnard, who has been awarded the contract. The completed building will occupy a space 50 by 100 feet with 50 foot frontage, and be three storeys high.

Ottawa, Ont.—Tenders are being called for a public building at Palmerston, Ont. Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Mr. Thos. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, Ont., the postmaster, Palmerston, Ont., and at the Department of Public Works, Ottawa.

Ottawa, Ont.—Tenders will be received up to Monday, July 13, for the erection of postal station "E" at Toronto, Ont. Plans, specifications and form of contract can be seen and forms of tender obtained at the office of Thos. A. Hastings, Clerk of Works, Postal Station "F," Yonge Street, Toronto, Ont., and at the Department of Public Works, Ottawa.

Toronto, Ont.—A new large five-storey building is to be erected at Nos. 176 to 180 John Street, just a little north of Queen Street, by the F. S. Thomas Co., bookbinders. The cost of the site and building will be about $160,000, the land having been purchased some time ago for about $30,000. The dimensions of the site are 30 feet by 110 feet, and it is the intention of the company to occupy a portion of the new building and let the balance. S. L. Yolles is the architect

Toronto, Ont.—The contract has been let and construction work will begin almost immediately on a new branch bank building to be erected at the south-west corner of McCaul and St. Patrick streets. The structure will cost about $30,000. The site for the building was purchased some time ago at $800 a foot, and consists of about 40 feet frontage on St. Patrick street by a depth of about 100 feet on McCaul street. The total outlay for land and building is, therefore, over $50,000.

Toronto, Ont.—A. A. Barthelmes and Frederick Courtemanche, of Toronto, have purchased the southwest corner of Teraulay and Albert streets and will erect a ten-storey office building to cost in the neighborhood of $300,000. The new structure will be the latest word in office building construction, and will be of steel and brick construction and possibly have a white terra cotta exterior. The property, which is now vacant, has 50 feet frontage on Teraulay street and 164 feet frontage on Albert street. The land assessment amounts to $25,000. It is likely that the new skyscraper will be tenanted almost wholly by law firms, for which it is admirably situated.

Wood Working

Huntsville, Ont.—The Muskoka Wood Manufacturing Co. will rebuild their saw mill.

Montreal, Que.—A fire on June 16, destroyed the sash and door factory of Jasmin and Cantin. The loss on the building, machinery and contents is estimated at $20,000, on which there is $5,000 insurance.

Montreal, Que.—Fire in the saw mill and sash and door factory of Paul Beaudry, 637 Davidson street, on June 11 did damage to the extent of about $60,000. Thousands of feet of sawn lumber were destroyed.

Nelson, B.C. — By agreement with Forest Mills Co. of British Columbia, J. S. Deschamps of Rossland, will shortly commence construction at Nelson of a

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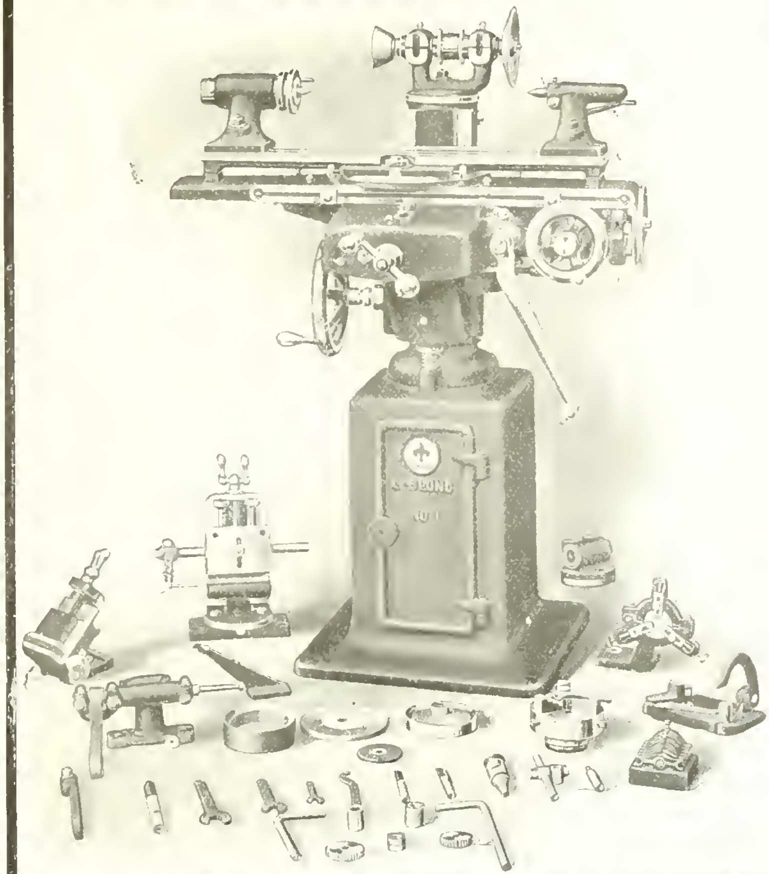

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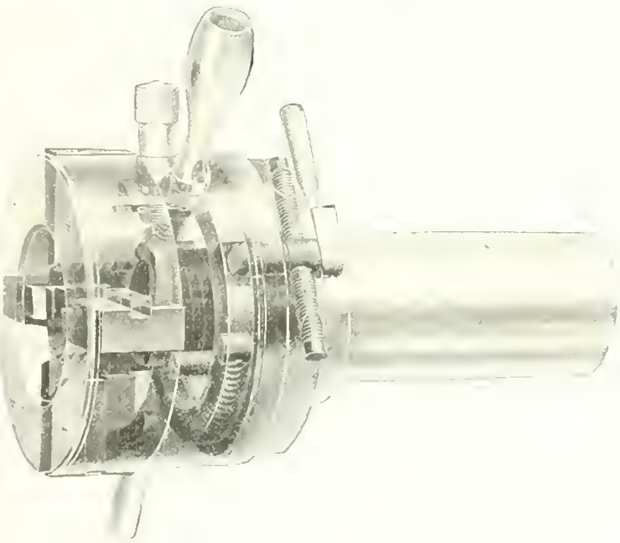

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big lumber mill on the site owned by Forest Mills.

Ottawa, Ont.— Mr. Ritchie, whose mill was recently burnt in Aylmer, has begun plans for the rebuilding. It is reported that he has bought the machinery and equipment of McKay's mill, which is farther up in the country. This equipment will be removed to Aylmer and installed in the new mill.

Contracts Awarded

Regina, Sask.—The contract has been awarded to R. D. Wood & Co. for 77 fire hydrants at a total cost of $3,383.38; and to Jenkins Bros., Ltd., for gate valves at a total cost of $3,383.57.

Stratford, Ont.—A contract has been awarded to the Canadian Allis-Chalmers, Ltd., for the supply of two new boilers to be installed at the civic pumping station.

Ottawa, Ont.—The Government has awarded to Marois and Girard the contract for a new public building at Jonqueres, Que. The cost will be $20,850.

Shawinigan Falls, Que.—The contract for the foundations for the extensions to the paper mill of the Belgo-Canadian Pulp and Paper Co. has been let to Raymond Concrete Pile Co., of Montreal.

Victoria, B.C.—The contract has been awarded by the board of directors of the Royal Jubilee Hospital to the British Columbia Construction and Engineering Co., Victoria, B.C., for the erection of a laundry and power house to cost $27,575.

Swift Current, Sask.—The following contracts have been awarded by the town council: Mannesmann Tube Co., of Montreal, for cast iron and steel pipe with specials, at $7,566.75; Ressenlaer Valve Co., of Troy, N.Y., for hydrants, gate valves and boxes, at $1,741.25.

Transcona, Man.—The following contracts have been awarded by the town council: Canada Iron Corporation, Montreal, cast iron pipes; J. S. Neilson Co., Winnipeg, hydrants; McAvity & Sons, St. John, N.B., valves and valve boxes; Economy Foundry Co., Winnipeg, sewer castings.

Regina, Sask.—The Regina Plate Glass Co. has been awarded the contract for the plate glass which will be used at the new powerhouse. Over 5,000 square feet of wire glass will be used in the building, making one full carload. The glass will all be of British manufacture and will be in the city by the end of August.

Owen Sound, Ont. — The Provincial Hydro-Electric Commission have awarded contracts for two dams at Eugenia Falls, to the Ambursen Hydraulic Construction Co., of Montreal, and to Hyland, Scribbin & White, of Toronto. The contracts involve an expenditure of $230,000. Tenders are being called for hydraulic and electrical equipment capable of developing 4,000 h.p. The ultimate development will be 8,000 h.p.

Montreal, Que.—The contract has been awarded by the city of Montreal to W. E. Seagrave & Co. for the supply of auto fire apparatus as follows: One automobile salvage wagon; two automobile tractors, 60-h.p.; two automobile tractors, 80-h.p.; two hose wagons; one 85-ft. aerial ladder auto truck; one automobile fire engine of a capacity of 1,200 American gallons. The total amount of the contract is $81,300.

Tottenham, Ont.—The following contracts in connection with the waterworks system have been awarded by the Municipal Council. Water tank, Hunter Bridge and Boiler Co., of Kincardine; water pipes and specials, Page-Hersey Iron, Tube and Lead Co., Ltd., of Toronto; hydrants, Darling Pump and Mfg. Co., of Williamsport, Pa.; valves, London Foundry Co., of London; laying pipe, E. J. Hartnett, of Toronto; storage basin, Lewis Construction Co., of Toronto.

Montreal, Que.—The Cedar Rapids Manufacturing & Power Co. has just let a contract to Simpson Brothers, of Montreal, for dredging work. This work consists in the removal of the barrier at the head of the canal and dredging out the forebay immediately above the intake. There is involved the removal of about 175,000 yards of material, and the work is to be completed before the end of the year. Water will be admitted to the canal on November 1, and from that date the dredging will continue until completed.

Tenders

South Vancouver, B.C.—Tenders will be received for one "Marion" steam shovel, sets of rails and dump wagons. Plans and specifications may be obtained from Jas. B. Springford, South Vancouver, B.C.

Schomberg, Ont.—Tenders for the construction of two bridges in King Township will be opened at the meeting of the Township Council on June 27. The bridges are located at Cold Creek and Kettleby, and will cost about $1,600 each. They will be of reinforced concrete construction.

Winnipeg, Man.—Tenders will be received up to Tuesday, June 30, 1914, for the supply of cast iron water pipe and specials for the domestic water-works system. Specification and form of tender may be obtained at the office of the city engineer, 223 James Avenue, Winnipeg. M. Peterson, secretary Board of Control.

Winnipeg, Man.—Tenders will be received up to Tuesday, June 30th, 1914, for the supply of 150 6-inch hydrants for the domestic water works system. Specification and form of tender may be obtained at the office of the City Engineer, 223 James Avenue, Winnipeg. M. Peterson, Secretary, Board of Control.

Ottawa, Ont.—Tenders will be received up to Tuesday, July 14, for the construction of substructure and approaches for a bridge at Hawkesbury, Ont. Plans, specifications and form of contract can be seen at this department and at the offices of the district engineers, Shaughnessy Building, Montreal, P.Q.; Confederation Life Building, Toronto, Ont., and on application to the postmaster at Hawkesbury, Ont. R. C. Desrochers, secretary, Department of Public Works, Ottawa.

Toronto, Ont—Tenders will be received up to Tuesday, July 14, 1914, for the supply and delivery of one or two five-ton electrical chasses, equipped with steel-riveted tanks of 1,200 Imperial gallons capacity, together with sprinkling and flushing apparatus complete, for the city of Toronto. Conditions of tendering may be seen, and tender form obtained, together with all information relative thereto, at the offices of the Department of Street Cleaning, City Hall, Toronto.

Refrigeration

Regina, Sask.—A. Harrison, of Minneapolis, will build a $50,000 ice plant here. Building operations will commence shortly.

Calgary, Alta.—The ice factory being erected by the Crystal Ice Co., is to be of 50 tons daily capacity with "Arctic-Pownall" raw water ice-making system.

New Westminster, B.C.—The Columbia Cold Storage Co., are moving their plant to Steveston, B.C. Farrell & Fregent are the owners and George Cassidy is in charge of the new plant.

Vancouver, B.C.—The Vancouver & Prince Rupert Meat Co., it is reported, have made arrangements for building a cold storage warehouse and refrigerating plant at 71 Water Street, Vancouver.

Toronto, Ont.—The Lake Simcoe Ice Supply Co., T. G. Rogers, secretary, who have hitherto dealt only in natural ice, are asking tenders on a 100-ton ice

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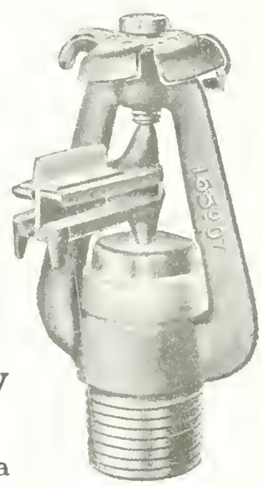

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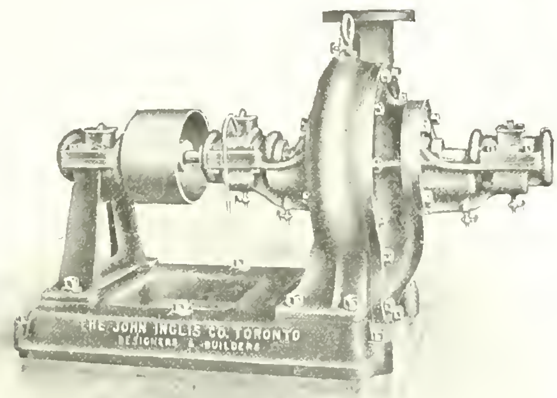

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manufacturing plant to be erected in the fall.

Vancouver, B.C.—The Sehushartie Bay Ice Co., who are building an ice factory at the north end of Vancouver Island, B.C., have let the contract for a 12-ton ammonia compression machine to the Armstrong Machinery Co., Spokane, Wash.

New Westminster, B. C. — The total cost of the new building and plant for the St. Mungo Cold Storage Co., will be about $40,000. The building will be 132 x 75 feet, two storeys high. James Anderson is the manager and William Hayman of Sapperton is the contractor.

Montreal, Que.—The Montreal Arena has made application to the Westmount City Council for permission to establish an ice manufacturing plant on the lot adjoining the Arena, and fronting on St. Catherine street and Western avenues. The present intention is to operate the plant only in winter for the purpose of insuring a perfect sheet of ice for the hockey season, but it will be available for manufacturing ice for commercial uses should it be decided to enter this field. The plant will have a capacity of 100 tons refrigeration per day. No opposition to the installation is expected, and as soon as the permit is secured the work will be begun and completed before winter.

Saskatoon, Sask.—Within two weeks representatives of the Saskatchewan Co-operative Abattoir and Cold Storage Association, the Rural Municipalities Association, the Grain Growers' Association and the Live Stock Association will wait upon the members of the Provincial Government and ask them to formulate a policy as to how best to establish a large and up-to-date packing plant at some central point in the province, to be co-operatively owned and operated. Hon. W. C. Sutherland states that an English syndicate, which had $15,000,000 available now for investment in the West, proposed to divide it up, spending $5,000,000 in each province and that if the Provincial Government would guarantee the bonds of the abattoir the company would purchase them and finance the scheme, if necessary, to the extent of $5,000,000.

Railways—Bridges

St. Catharines, Ont. — The Grand Trunk station at Thorold, was destroyed by fire on June 10, at an approximate loss of $10,000, partially insured. The cause of the fire is unknown.

Lamlash, Ont.—Tenders will be received by Geo. Brown, Lamlash, until June 30, for the erection of a steel bridge over a branch of the Saugeen River, 42 ft. span. Jas. Warren, engineer, Walkerton, Ont.

Calgary, Alta.—Tenders are called for construction of a four-span concrete and structural steel bridge, 20 feet wide, carrying one steel railway track. The estimated cost is $90,000. Engineer, Geo. W. Craig.

T. & N. O. Railroad.—The first solid steel train to be operated in Canada by a Canadian road, arrived in Toronto on June 18, from Chicago. The Pullman Company turned out this six-coach steel train, including baggage car, for the T. & N. O. road, at a cost of $140,000. Another steel train is under completion in Chicago, and will be turned out shortly.

Vancouver, B.C. — C.P.R. engineers and surveyors left Campbell River, B.C., recently in two parties working on the preparation of surveys to carry the line of the Esquimalt and Nanaimo Railway northward along the shore of Vancouver Island. One survey party is working south of Campbell River, and one north, the latter proceeding along the trail built by the government into the Salmon River Valley. It is stated that the intention of the C.P.R. is to build eventually to the north end of Vancouver Island.

Trade Gossip

W. D. Beath & Son, Ltd., Toronto, have been awarded a contract for three 7-ton stiff leg derricks with 50-ft booms for operating grab buckets on the Trent Valley Canal at Ragged Rapids, Ont.

Haywood & Dods, Ltd., of Victoria, B.C., have been awarded a contract by the Dominion Government for the installation of a heating and ventilating system in a public building at Victoria, B.C.

The A. & P Steven Co., Glasgow, Scotland, have been awarded a contract by the Toronto, Ont., Board of Works for the supply and installation of an electric elevator for the City Hall at a cost of $4,300.

Grimsby, Ont.—Fire on June 18, broke out at the plant of the Consumers' Lumber & Box Co., doing damage to the extent of $25,000. The place was practically burned to the ground, and over $7,000 worth of new machinery, installed within the past few days, was destroyed. Insurance amounts to $12,000.

The Storey Pump & Equipment Co., Kent Bldg., Toronto, Ont., of which M. E. Storey is manager, have secured the agency for the Ontario district of the International Steam Pump Co., which comprises the following associated companies:—Blake-Knowles Steam Pump Works, Snow Steam Pump Works, Deane Steam Pump Co., and Henry R. Worthington.

Canada Machinery Corporation, Galt, Ont.—In connection with the new financing recently carried out by this company whereby $150,000, additional working capital was provided by the shareholders, certain changes in the management have taken place through the retirement of T. F. Kenny as general manager. T. H. Watson, the newly elected president, will in future assume that position, and take an active part in directing the company's affairs.

The Smart Turner Machine Co., Hamilton, Ont., recently received orders for the following equipment:—Barfelt & Co., London, Ont., one vertical centrifugal pump; the Coniagas Reduction Co., Thorold, Ont., one centrifugal pump; the London Cold Storage & Warehouse Co., London, Ont., one duplex pump; the Canada Glue Co., Brantford, Ont., one duplex pump; the Imperial Oil Co., Sarnia, Ont., one vertical triplex pump.

The Turbine Equipment Co., Ltd., Toronto, have secured a contract from the Brantford Corporation for the new pumping plant. Two of these pumps will be De Laval 12-in. multi-stage, each direct connected to a 250 h.p. Canadian Westinghouse synchronous motor. The output of each unit will be four million Imperial gallons per day against 200 ft. head. The company are also supplying two booster pumps which will be of the De Laval steam turbine driven single-stage double suction type. High speed turbines will be used so as to obtain a maximum of economy, and De Laval double helical reduction gears will be fitted to reduce the pump speed to 1,800 r.p.m. The output of each unit will be four million Imperial gallons per day against 100 ft. head, and in case the electrical power is out of commission, these two pumps will be arranged to run in series. In case of fire either booster pump can run in series with either electrically driven domestic pump.

New Incorporations

The Grimsby Specialty Co., Ltd., has been incorporated at Toronto, with a capital of $50,000, to carry on business as soap manufacturers at Grimsby, Ont. Incorporators—C. W. Livingston, A. C. McNaughton and V. H. Johnston, of Toronto.

The Harvey National Supply & Mfg. Co., Ltd., has been incorporated at Toronto, with a capital of $50,000, to manufacture automobile kitchenettes and stoves at Toronto. Incorporators—J. M. Harvey, W. W. Stoddart, and E. McFadden, all of Toronto.

Marine

Port Credit, Ont.—The Dominion Government have made a grant of $50,000 for harbor improvements here.

St. Catharines, Ont.—On June 10, the steamer "Pueblo," owned by the Canada Cement Co., on entering lock No. 9, of the Welland canal, struck the gates, with the result that six gates were washed away and navigation tied up for four days.

The Great Lakes and Atlantic Canal and Power Co., Ltd., has been incorporated at Ottawa, with a capital of $250,000, to carry on business as marine surveyors at Montreal. Incorporators—F. A. Morgan, G. A. Morrison, and H. Stanislaus, of Montreal.

Collingwood, Ont.—Amongst the new companies recently incorporated appears the name of the Georgian Bay Navigation Co., of Owen Sound, with a capital of $40,000. This is the company that bought Captain Cleland's boat, the S. S. Soo City.

Sarnia, Ont.—According to report, the Reid Wrecking Co., will establish a coaling station at Point Aux Barques with the coal they are taking from the steamer Hanna, aground at Point Aux Barques since the big storm of November last year. The Hanna has over 10,000 tons of coal aboard.

South Vancouver, B.C.—The Dominion Government has appropriated $10,000 for two wharves, one to be built here and the other at Eburne, the grant being provisional upon the donation of sites by the municipalities of Point Grey and Eburne, according to a report made public by Mr. W. J. Prowse at a meeting of the Main Street Improvement Association on May 26.

St. Catharines, Ont.—The big dredge Delver, valued at $100,000, owned by the Dominion Dredging Co., contractors for No. 1 section Welland ship canal, capsized and sank on June 14 in a gale, while the tug Alice, of Port Dalhousie was endeavoring to take it into the harbor from Port Weller, where she had been engaged with other dredges in making a harbor for the new ship canal.

Quebec, Que.—A new dredge just out of the builders' hands arrived here on June 12, having crossed the Atlantic under her own steam. She is of the bucket pattern and capable of removing 1,000 tons of material an hour. The buckets have not yet been fitted, but as soon as this is done she will be able to commence operations and thus push forward the improvements now in progress at this port.

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FOR SALE

White Rock, B.C. — The Dominion Government has appropriated $5,000 for building a wharf here. Work will begin at once.

Captain L. A. Demers has resigned his position as harbormaster of the Port of Montreal, and has been appointed wreck commissioner.

Point Grey, B.C.—Harbor Commissioner Hodgson states that the Dominion Government have made a grant of $10,000 to the North Fraser Harbor Commissioners for the purpose of constructing wharfs at both Eburne and South Vancouver. These wharfs, so Mr. Hodgson intimated, would be constructed by the commissioners just as soon as the municipalities affected would designate and supply the sites.

Victoria, B.C.—With a view to making an immediate start in the construction of the reinforced concrete cribs that will be a feature of the two ocean piers to be erected at Ogden Point, Grant, Smith & McDonnell, the contractors, are now engaged in overhauling and assembling the plant and material alongside the big floating drydock in readiness for the preliminary operations. Two concrete cribs of approximately 3,500 tons each in weight will be built simultaneously on the drydock, and the first of these huge caissons will be put together aboard the craft at the point where she is now moored in the Inner Harbor.

Sault Ste. Marie, Ont.—The first important vessel deal of the year was closed on May 26, when E. D. Carter, of Erie, sold the steel steamer E. D. Carter to the Algoma Central Steamship Line, of Sault Ste. Marie, Ont. The price was not given out. The Carter has a capacity of about 9,000 tons, and was built in Wyandotte in 1908. She is of arch construction, with side tanks, and is 524 feet over all, 504 feet keel, 54 ft. beam, and 30 ft. deep, with gross tonnage of 6,359. The Algoma Steamship Co. has been in the market for steel ships of this size for several months, but until recently had been unable to get a price that would meet their views.

Toronto, Ont.—Another lake merger which it is expected will be consummated in a few days, is under way in which the Farrar Transportation Co., Ltd., grain and general forwarders, Collingwood, are involved. The new company, to be known as the Gulf & Lake Navigation Co., is being organized to operate about sixteen steamers. It is understood that Mr. J. W. Norcross, managing director of Canada Steamship Lines, and some American vessel interests are putting through the deal. Mr. Norcross admitted that while such a move was on foot, the new company would not have connection with the Canadian Steamship Lines directly or indirectly.

New Incorporations

The Cumshewa Iron Mines, Ltd., have been incorporated at Victoria, B.C., with a capital of $100,000. Head office at Victoria.

The Weno Power & Light Co. has been incorporated with a capital of $100,000, to carry on business at Calgary, Alta.

The Barclay Shingle Mills, Ltd., have been incorporated at Victoria, B.C., with a capital of $20,000. The head office is at Vancouver, B.C.

The Courtenay Electric Light & Power Co. has been incorporated with a capital of $50,000 to operate a power plant at Courtenay, B.C.

The Wisconsin Bridge & Iron Co. has obtained a license at Toronto with a capital of $40,000 to carry on business as bridge builders in Ontario. Incorporator:—G. C. Loveys, of Toronto, Ont.

The Fibre Boxes Co., Ltd., has been incorporated at Toronto with a capital of $40,000 to manufacture boxes at Toronto. Incorporators: T. H. Goldring, J. T. Loftus, and W. H. Ford, all of Toronto.

The Lethbridge Brick Co., Ltd., has been incorporated at Toronto with a capital of $30,000 to manufacture bricks at Steelton, Ont. Incorporators:—W. W. Lethbridge, C. L. Belyea, and A. M. Wade, all of Steelton.

The Georgian Bay Navigation Co., Ltd., has been incorporated at Toronto with a capital of $40,000 to build steam ships at Owen Sound. Incorporators: M. D. Lemon, H. W. Lemon, and J. K. McLauchlan, of Owen Sound.

The Blachford Shoe Manufacturing Co., Ltd., has been incorporated at Toronto with a capital of $40,000 to manufacture boots and shoes at Toronto. Incorporators: G. Adams, M. MacDonald, and E. Smiley, of Toronto.

The F. W. Fearman Co., Ltd., has been incorporated at Toronto with a capital of $500,000 to carry on business as pork packers at Hamilton, Ont. Incorporators: G. D. Fearman, H. A. Burbidge, and J. R. Marshall, all of Hamilton.

The Atlas Shipping Co., Ltd., has been incorporated in Ottawa, Ont., with a capital of $250,000 to carry on business as shipbuilders in Montreal. Incorporators:—Edwin Howard, Jacob De-Wett, Henry C. McNeil, all of Montreal, Que.

The Royal Laundry Co., Ltd., has been incorporated at Toronto with a capital of $40,000 to carry on business as

laundry proprietors at Hamilton, Ont. Incorporators:—E. L. Middleton, T. L. Monahan, and F. Morrow, all of Toronto.

The Alexander Hamilton Institute has been licensed at Toronto with a capital of $25,000 to print and publish books, magazines, etc., at Toronto, Ont. The corporation has appointed L. Le Roy Fleck, of Toronto, to be its attorney.

The Canadian-Detroit Steel Products, Ltd., has been incorporated at Toronto with a capital of $40,000 to deal in iron, steel, and other metal products at Windsor, Ont. Incorporators:—H. C. Bulkley, S. K. Pittman, and J. G. Rumney, all of Detroit.

Catalogues

Motor Generator Sets.—The Lincoln Electric Co., Cleveland, Ohio, have issued a bulletin descriptive of the "Lincoln" motor generator sets for automobile battery charging and other transforming purposes. Full particulars are given of these sets with illustrations, showing their general arrangement.

Electric Hoists.—The Detroit Hoist & Machine Co., Detroit, Mich., have sent us a catalogue dealing with the portable and mono-rail types of electric hoists which they make. The catalogue is fully illustrated showing the various types of hoist accompanied by a brief description of each with principal dimensions and prices.

Starting Switches, self-acting type for a.c. motors are dealt with at length in pamphlet No. 611, recently issued by the Igranic Electric Co., Ltd., London, England. Several applications of the "Igranic" starting switches for push button, remote, pressure or float control are described and accompanied by illustrations.

The Elliott Company, Pittsburgh, Pa., have published Bulletin No. 89, which has as its subject "How to Take Oil Out of Boiler Feed Water." The bulletin deals with the "Elliott" grease extractors applied to pumping stations, and covers the subject in a comprehensive manner. An illustration is included showing the "Elliott" twin filter and grease extractor.

Overhead Traveling Cranes. — The Herbert Morris Crane & Hoist Co., Toronto, are distributing bulletin B6, dealing with type "G" overhead traveling cranes. The bulletin contains illustrations of several important installations, one showing a 30-ton capacity crane in position. A diagram is included with table giving the principal dimensions, working load and spans for the various sizes.

McLain's System.—A folder is being distributed by McLain's System, Milwaukee, Wis., setting forth a few claims made by the company for their system for reducing losses in the foundry. A post card is attached so that any interested reader desiring full information can mail same to the company who will send literature free of charge.

Electric Hoists and their application is the subject of bulletin 301A being distributed by the Pawling & Harnischfeger Co., Milwaukee, Wis. The bulletin deals, as the title indicates, with electric hoist installations and contains a brief description of a number of these. The illustrations show the wide application of these hoists and their general utility.

Air Compressors and Vacuum Pumps.—The Mesta Machine Co., Pittsburgh, Pa., have sent us a copy of Bulletin N., devoted to a description of the air compressors and vacuum pumps which they make. The bulletin contains a description of the principal features embodied in the design of the above equipment. Included with the illustrations are reproductions of indicator cards and a volumetric efficiency diagram.

Hoisting Machinery, is the subject of a catalogue recently issued by the Detroit Hoist & Machine Co., Detroit, Mich. The products dealt with in this catalogue include pneumatic and electric-geared hoists, locomotive turntable tractors and other portable hoisting appliances. Illustrations are given covering the various types accompanied by brief descriptions and tables giving the capacities and principal dimensions.

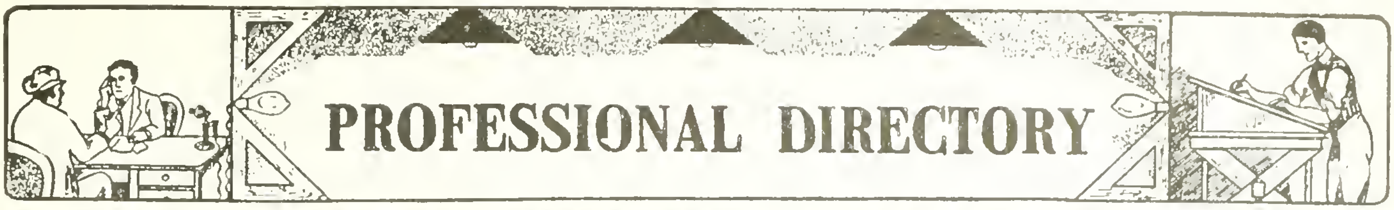
Boring Mills.—"The Driving Box Special" of the Gisholt lines is the title of a bulletin B.M.F. 1 dealing with the 42-in. boring mill made by the Gisholt Machine Co., Madison, Wis. The bulletin contains some interesting information on machining locomotive driving boxes, together with the results of a time test made on a "Gisholt" mill. Among the illustrations are two views showing the method of setting an axle box on the boring mill and the relative position of the boring tool.

Wagon and Truck Loaders made by the Link-Belt Co., Philadelphia, Pa., are described in catalogue No. 190, which we have received. The Link-Belt portable wagon and truck loaders dealt with in this catalogue are designed for loading loose materials, such as coal, sand and gravel, and their suitability for this work is clearly demonstrated by means of numerous illustrations showing the loaders in operation. Specifications are given for several types and a few testimonials and partial list of users are also included.

BOOK REVIEWS.

Engineering Workshop Exercises, by Ernest Pull, A.M.I.M.E., 78 pages, $7\frac{1}{4}$ x $4\frac{3}{4}$, 37 drawings and illustrations, published by Whittaker & Co., London England; price 50 cents, net. This is a handy little book arranged in the form of a series of lessons or exercises on engineering workshop practice. The lessons are designed to meet the requirements of students in technical schools, and embrace general fitting and machine work. The book will be equally useful for apprentices, as the exercises cover the problems which confront the young mechanic in the shop. The subjects dealt with are all of a practical nature and include chipping and filing, drilling, scraping, forging, turning, etc., while several exercises are devoted to explaining how to make calipers, squares, chisels, etc. Other exercises deal with screw threads and gauges. A chapter is devoted to screw cutting and notes on materials, while the concluding pages contain some useful tables on alloys, specific gravity, melting point and physical properties of metals, etc. This book should be of great assistance to the student and apprentice in helping him to learn the correct method of using tools to obtain the proper degree of accuracy in his work.

Practical Iron Founding, by Joseph G. Horner, A.M.I.M.E., 404 pages, $7\frac{1}{2}$ x $4\frac{3}{4}$, 283 illustrations, published by Whittaker & Co., London, England; price $1.25 net. This is the fourth edition of the work revised and enlarged, parts having been re-written on account of the great changes that have taken place in foundry practice in recent years. The author has frequently contributed to our columns, therefore readers of Canadian Machinery will appreciate the value of the information contained in this volume. Needless to say, the book is written from a thoroughly practical viewpoint, and is intended for the use of both the student and the molder. The book is arranged in such a manner that any person acquainted with the principles of molding and foundry operation should have no difficulty in following the text. It contains sixteen chapters covering 347 pages, the remaining pages comprising an appendix. Chapters one to seven deal with sands, varieties of iron, cupolas, shops and equipment, molding boxes, etc., while the following chapters deal more with actual molding and cover such subjects as green and dry sand molding, cores, loam work, machine molding, examples of molding machines, machine molded gears, miscellaneous economies, etc. The appendix contains 15 tables, giving a great deal of useful information on sand mixtures, ropes, chains, fans, blowers, weights of various metals, etc. The illustrations are numerous, well arranged and distinct.



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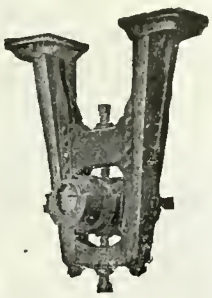

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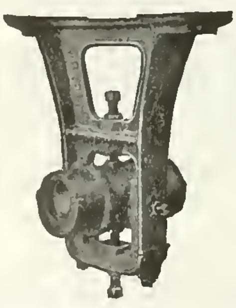

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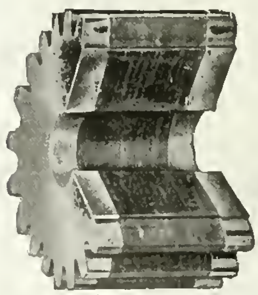

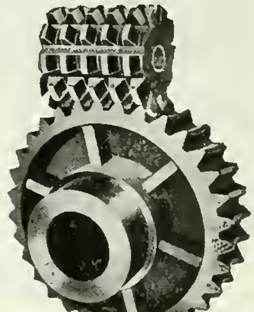

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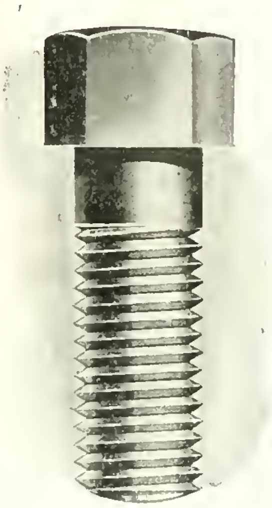

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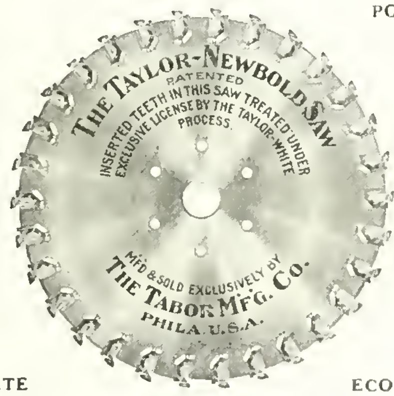

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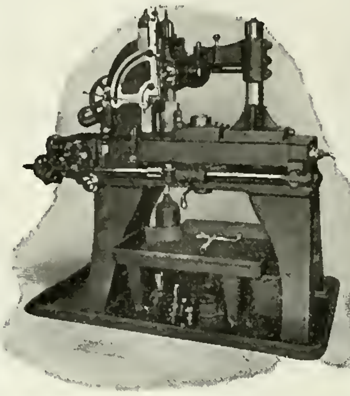

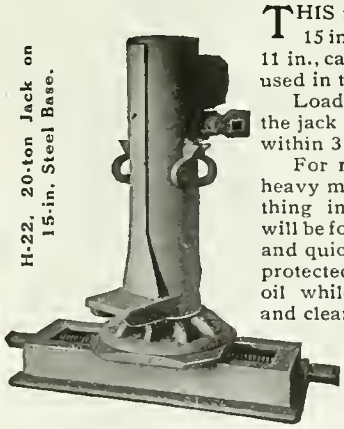

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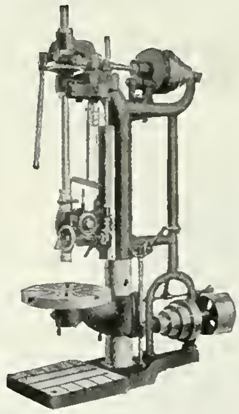

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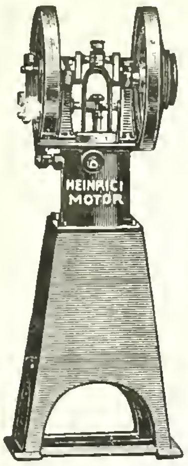

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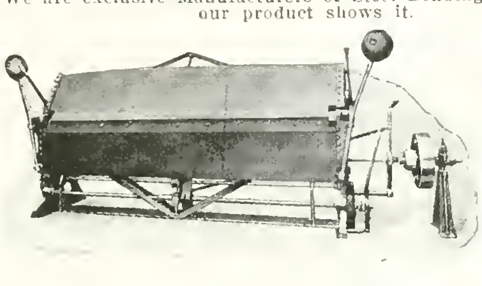

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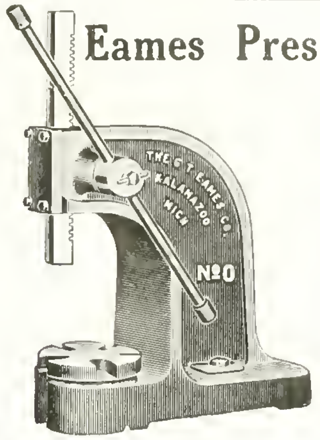

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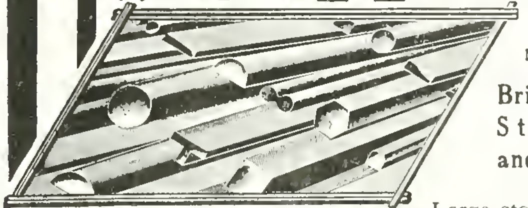

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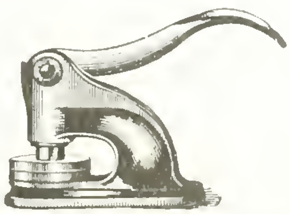

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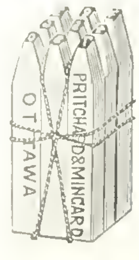

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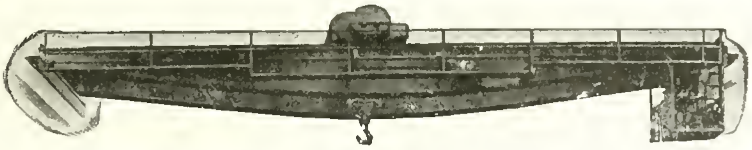

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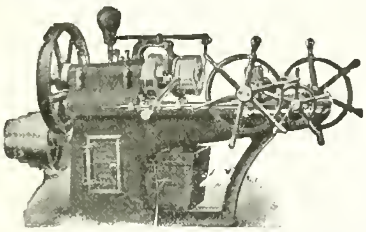

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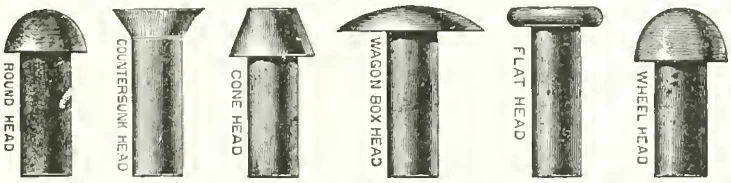

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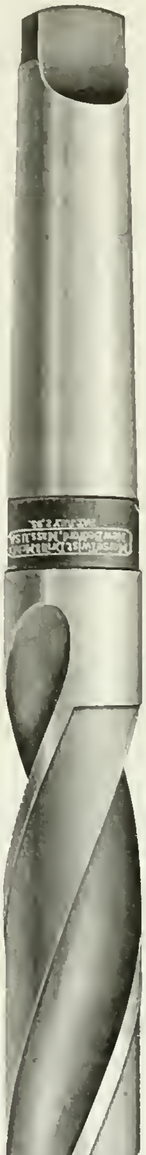

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Belting Rubber.
Goodyear Tire & Rubber Co., Toronto.

Bending Machinery.
John Bertram & Sons Co., Dundas.
Bertrams, Limited, Edinburgh, Scotland.
Bliss, E. W., Co., Brooklyn, N.Y.
Canada Mach. Corporation, Galt, Ont.
Jardine, A. B., & Co., Hespeler, Ont.
Mussens, Limited, Montreal.
National Machinery Co., Tiffin, Ohio.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
Owen Sound Iron Works Co., Owen Sound.
Toledo Machine & Tool Co., Toledo, O.
Steel Bending Brake Works, Chatham, Ont.

Bit Brace Tools.
Wells Bros. Co., Greenfield, Mass.

Blast Gauges, Cupola.
Sheldons, Ltd., Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Blocks, Lifting.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
John Millen & Son, Ltd., Montreal.
Northern Crane Works, Walkerville.

Blowers.
Sheldons, Ltd., Galt, Ont.
W. S. Rockwell Co., New York.

Blow Pipes.
L'Air Liquide Society, Toronto.

Bluing Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Boilers.
International Engineering Works, Ltd., Amherst, N.S.
John Inglis Co., Toronto.
Mussens, Limited, Montreal.
National Machinery & Supply Co., Hamilton.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.

Boiler Compounds.
Hall Engineering Works, Montreal.
Can. H. W. Johns-Manville Co., Toronto.

Boiler Feed Regulators.
Gray Mfg. & Machine Co., Ltd., Toronto.

Boiler Graphite.
Dixon Crucible Co., Jersey City, N.J.

Boiler Makers' Supplies.
Jno. F. Allen Co., New York.

Bolt Cutters and Nut Tapers.
Wells Brothers Co., Greenfield, Mass.

Bolts.
Galt Machine Screw Co., Galt, Ont.
Steel Co. of Canada, Hamilton, Ont.
Northern Bolt & Screw Co., Owen Sound, Ont.
London Bolt & Hinge Works, London, Ont.

Bolt and Nut Machinery.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas, Ont.
Owen Sound Iron Works Co., Owen Sound.

Canada Mach. Corporation, Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
Landis Machine Co., Waynesboro, Pa.
Mussens, Limited, Montreal.
National Machinery & Supply Co., Hamilton.
Wiley & Russell Co., Greenfield, Mass.

Books.
MacLean Publishing Co., Toronto.

Boring Bars.
Marvin & Casler Co., Canastota, N.Y.

Boring Heads.
Marvin & Casler Co., Canastota, N.Y.

Boring Machines, Upright and Horizontal.
John Bertram & Sons Co., Dundas.
Canada Mach. Corporation, Galt, Ont.
Mussens, Limited, Montreal.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
Stow Mfg. Co., Binghampton, N.Y.

Boring Machines, Pneumatic, Cylinder.
Baker Bros., Toledo, O.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Canada Mach. Corporation, Galt, Ont.
Independent Pneumatic Tool Co., Chicago, Ill.
Mussens, Limited, Montreal.
Stow Mfg. Co., Binghampton, N.Y.

Boring and Turning Mills.
John Bertram & Sons Co., Dundas.
Canada Mach. Corporation, Galt, Ont.
Mussens, Limited, Montreal.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.

Box Puller.
Jardine, A. B., & Co., Hespeler, Ont.

Boxes, Steel Shop.
Cleveland Wire Spring Co., Cleveland.

Boxes, Tote.
Cleveland Wire Spring Co., Cleveland.

Brakes.
Brown, Boggs & Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Brass Working Machinery.
A. R. Williams Machy. Co., Toronto.
Gardner, Robt., & Son, Montreal.
Mussens, Limited, Montreal.
National Machinery & Supply Co., Hamilton.
Warner & Swasey Co., Cleveland.
Niles-Bement-Pond Co., New York.

Brazing Compounds.
Phillips-Laffitte Co., Philadelphia.

Brick Cars.
Sheldons, Ltd., Galt, Ont.

Brick Dryers.
Sheldons, Ltd., Galt, Ont.

Brick Machinery.
Eastern Machinery Co., New Haven.
Sheldons, Ltd., Galt, Ont.

Bridges, Railway and Highway.
Can. Bridge Co., Walkerville, Ont.

Bucket Tanks.
General Fire Equipment Co., Toronto.

Buckets, Clam Shell, Crab and Dump.
Whiting Foundry Equipment Co., Harvey, Ill.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Buffing and Polishing Machinery.
Abbott Ball Co., Hartford, Conn.
Gray Mfg. & Machine Co., Ltd., Toronto.

Bulldozers.
John Bertram & Sons Co., Dundas.
Canada Mach. Corporation, Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.

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Wells Brothers Company, Greenfield, Mass.

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Gray Mfg. & Machine Co., Ltd., Toronto.
Mussens, Limited, Montreal.
Sheldons, Limited, Galt.
Whiting Foundry Equipment Co., Harvey, Ill.

Cask Lifting Machinery.
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Aluminum Castings, Ltd., Ottawa.
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Castings, Brass.
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Castings, Bronze.
Aluminum Castings, Ltd., Ottawa.
Tallman Brass & Metal Co., Hamilton.

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Owen Sound Iron Works Co., Owen Sound.
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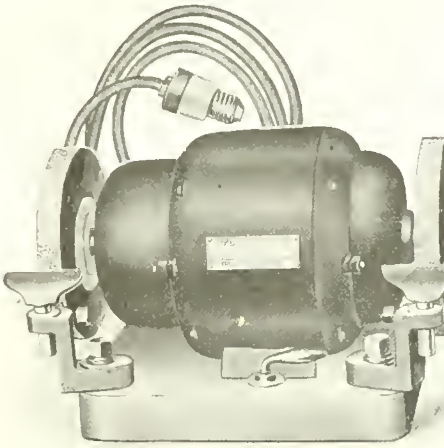

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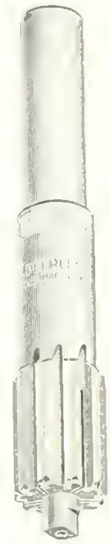

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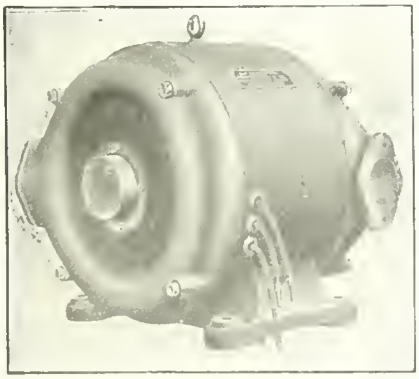

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Standard Electric Tool Co., Cincinnati, O.

Drill Presses.
A. R. Williams Machy. Co., Toronto.
Foss & Hill Machy. Co., Montreal.
Wiley & Russell, Greenfield, Mass.

Drills, Ratchet and Hand.
Armstrong Bros. Tool Co., Chicago.
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Twist Drill Co., Cleveland.
Detroit Twist Drill Co., Detroit, Mich.
A. B. Jardine & Co., Hespeler Ont.
Morse Twist Drill and Machine Co., New Bedford.
Mussens, Limited, Montreal.
Chas. Parker & Co., Meriden, Conn.
Pratt & Whitney Co., Dundas, Ont.
Standard Electric Tool Co., Cincinnati, O.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drills, Rock.
A. R. Williams Machy. Co., Toronto.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Foss & Hill Machy. Co., Montreal.
Mussens, Limited, Montreal.

Drills, Scotch Radial, Portable Electric.
Cincinnati Electrical Tool Co., Cincinnati.
Standard Electric Tool Co., Cincinnati, O.

Drills, Track.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill and Machine Co., New Bedford.
Mussens, Limited, Montreal.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drills, Twist.
Armstrong, Whitworth of Canada, Ltd. Montreal.
Can. Fairbanks-Morse Co., Montreal.
Hermann Boker & Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Detroit Twist Drill Co., Detroit, Mich.
Morse Twist Drill and Machine Co., New Bedford.
Mussens, Limited, Montreal.
Pratt & Whitney Co., Dundas, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

Drill Holders.
Wells Brothers Co., Greenfield, Mass.

Drill Sockets.
Detroit Twist Drill Co., Detroit Mich.
Modern Tool Co., Erie, Pa.
Morse Twist Drill and Machine Co., New Bedford, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drying Appliances.
Sheldons, Ltd., Galt, Ont.

Drying Out Barrels.
Baird Machine Co., Bridgeport, Conn.

Drying Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.
Whiting Foundry Equipment Co., Harvey, Ill.

Dump Cars.
Can. Fairbanks-Morse Co. Montreal.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Mussens, Limited, Montreal.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.

Dust Separators.
Sheldons, Ltd., Galt, Ont.

Dynamos and Electrical Supplies.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co. Montreal.
Canadian Westinghouse Co., Hamilton.
Hall Engineering Works, Montreal.
Lancashire Dynamo and Motor Co., Ltd., Toronto.
T. & H. Electric Co., Hamilton.
Electrical Maintenance & Repairs Co., Toronto.

Electrical Sanitary and Construction Work.
Can. Safety Engineering Bureau, Toronto.

Elevating and Conveying Machinery.
Barkey Bros., Stouffville, Ont.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Plessisville Foundry, Plessisville, Que.

Emery Grinders (Pneumatic).
Barkey Bros., Stouffville, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Stow Mfg. Co. Binghamton, N.Y.

Emery and Emery Wheels.
Can. Fairbanks-Morse Co., Montreal.
Gray Mfg. & Machine Co., Ltd., Toronto.
Ford-Smith Machine Co., Hamilton.
Garvin Machine Co., New York.
Mussens, Limited, Montreal.
Stevens, F. B., Detroit, Mich.

Emery Wheels, Dressers and Stands.
Ford-Smith Machine Co., Hamilton.
Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
Mussens, Limited, Montreal.
Norton Co., Worcester, Mass.

Emery Wheel Safety Flanges.
Ford-Smith Machine Co., Hamilton.
Gray Mfg. & Machine Co., Ltd., Toronto.

Emery Wheel Protection Hoods.
Ford-Smith Machine Co., Hamilton.

Enameling Ovens.
Oven Equipment & Mfg. Co. New Haven, Conn.

Engineers, Inspecting.
Milton Hersey Co., Montreal.

Engines, Gas and Gasoline.
Can. Fairbanks-Morse Co., Montreal.
Jones & Glassco, Montreal.
National Machinery & Supply Co., Hamilton.

Engines, Horizontal and Vertical.
A. R. Williams Machy. Co., Toronto.
Sheldons, Ltd., Galt, Ont.

Engines, Steam.
John Inglis Co., Toronto.
Plessisville Foundry, Plessisville, Que.

Elevators and Buckets.
Eastern Machinery Co., New Haven, Conn.
Whiting Foundry Equipment Co., Harvey, Ill.

Engravers.
Pritchard-Andrews Co. Ottawa.

Equipment, Shop.
Garvin Machine Co., New York.

Escutcheon Pins.
Parmenter & Bulloch Co., Gananoque.

Evaporators' Machinery.
Brown, Boggs & Co., Hamilton, Ont.

Exhaust Heads and Hoods.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Limited, Galt, Ont.

Exhausters.
Sherbrooke Machinery Co., Sherbrooke, Que.

Experimental Machinery.
Owen Sound Iron Works Co., Owen Sound.

Fans.
Can. Buffalo Forge Co., Berlin, Ont.
Baird Machine Co., Bridgeport, Conn.
Canadian Westinghouse Co., Hamilton.
Plessisville Foundry, Plessisville, Que.
Sheldons, Limited, Galt, Ont.
The Smart-Turner Machine Co., Hamilton.

Feed Water Heaters.
Can. Fairbanks-Morse Co., Montreal.
Inglis Co., John, Toronto.
The Smart-Turner Machine Co., Hamilton.

Files.
Delta File Works, Philadelphia, Pa.
Nicholson File Co., Port Hope, Ont.
Simonds Mfg. Co., Fitchburg, Mass.

Fire Sprinklers, Automatic.
General Fire Equipment Co., Toronto.

Fire Extinguishers.
General Fire Equipment Co., Toronto.

Flanged Pulleys.
American Pulley Co. Philadelphia.

Flexible Shafts.
Stow Mfg. Co., Binghamton, N.Y.

Forges, Hand, etc.
Independent Pneumatic Tool Co., Chicago, Ill.
National Machinery & Supply Co., Hamilton.
W. S. Rockwell Co., New York.
Sheldons, Limited, Galt, Ont.

Forges, Oil Rivet.
W. S. Rockwell Co., New York.

Forgings, Drop, Automobile and Locomotive.
Bliss, E. W., Co., Brooklyn, N.Y.
Canadian Billings & Spencer Ltd., Welland.
Castings of Ottawa, Ottawa, Ont.
J. H. Williams & Co., Brooklyn, N.Y.

Forging Hammers, Belt-Driven.
Plessisville Foundry, Plessisville, Que.

Forging Hammers, Steam.
Erie Foundry Co., Erie, Pa.

Forging Ingots.
Electric Steel & Metals Co., Welland.

Forging Machinery.
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Erie Foundry Co., Erie, Pa.
Canada Machinery Corp. Galt, Ont.
National Machinery Co., Tiffin, Ohio.
Plessisville Foundry, Plessisville, Que.

Foundry Equipment.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Friction Clutch Pulleys, etc.
Eastern Machinery Co., New Haven, Conn.
Owen Sound Iron Works Co., Owen Sound.

Friction Hoists.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Furnaces, Annealing, etc.
W. S. Rockwell Co., New York.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces for Baking, Bluing, Drying, Enameling, Japanning and Lacquering.
Oven Equipment & Mfg. Co., New Haven, Conn.
Gray Mfg. & Machine Co., Ltd., Toronto.

Galvanizing Machinery.
Erie Foundry Co. Erie, Pa.

Gang Planer Tools.
Armstrong Bros. Tool Co., Chicago.

Gaskets.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Gas Blowers and Exhausters.
Sheldons, Limited, Galt.

Gas Burners.
Oven Equipment & Mfg. Co., New Haven, Conn.

Gas Machines.
Brown Boggs & Co., Hamilton, Ont.

Gas Producer Plants.
Can. Fairbanks-Morse Co., Montreal.

Gauges, Measuring.
Gronkvist Drill Chuck Co., Jersey City, N.J.
F. H. Scott Montreal.

Gauges, Standard.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
Mussens, Limited, Montreal.
National Machinery & Supply Co., Hamilton.
Schuchardt & Schutte, Toronto.
Wells Bros. Co. Greenfield, Mass.

Gear-Cutting Machinery.
A. R. Williams Machy. Co., Toronto.
Sheldons, Limited, Galt, Ont.
The Smart-Turner Machine Co., Hamilton.

Gears, Cut, Mortise, Angle Worm
Armstrong Bros., Toronto.
Gardner, Robt., & Son, Montreal.
Gray Mfg. & Machine Co., Ltd., Toronto.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal, P.Q.
Philadelphia Gear Co., Philadelphia.
John Millen & Son, Ltd., Montreal.
Schuchardt & Schutte, Toronto.
A. E. Whitehouse, Montreal.

Gears, Rawhide.
Gardner, Robt., & Son, Montreal.
A. E. Whitehouse, Montreal.
Gray Mfg. & Machine Co., Ltd., Toronto.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal, P.Q.
Philadelphia Gear Co., Philadelphia.
John Millen & Son, Ltd., Montreal.

Generators, Electric.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canadian Westinghouse Co., Hamilton.
Hall Engineering Works, Montreal.
Lancashire Dynamo and Motor Co., Ltd., Toronto.
Toronto & Hamilton Electric Co., Hamilton.

Grain for Polishing.
Norton Co., Worcester, Mass.

Grates, Shaking and Dumping.
Erie Foundry Co., Erie, Pa.

Graphite.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Jos. Dixon Crucible Co., Jersey City.
Detroit Foundry Supply Co., Windsor.
Stevens, F. B., Detroit, Mich.

Gravity Lowering Blocks.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Grinders, Automatic Knife.
W. H. Banfield & Son, Toronto.

Grinders, Centre, Pedestal and Bench.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Ford-Smith Machine Co., Hamilton.
Gray Mfg. & Machine Co., Ltd., Toronto.
Niles-Bement-Pond Co., New York.
Morse Twist Drill and Machine Co. New Bedford.
Rae Brothers, Hamilton, Ont.
Standard Electric Tool Co., Cincinnati, O.
Stow Mfg. Co., Binghamton, N.Y.
United States Electrical Tool Co., Cincinnati, O.

Grinders, Cutter.
R. K. LeBlond Machine Tool Co., Cincinnati, O.
Mussens, Limited, Montreal.
Pratt & Whitney Co., Dundas, Ont.
Schuchardt & Schutte, Montreal.

Grinders, Die Chaser.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.

Grinders, Disk.
Armstrong Bros., Chicago.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.
Mussens, Limited, Montreal.

Grinders, Drill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Mussens, Limited, Montreal.

Grinders, Cylinder, Internal.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Rivett Lathe & Grinder Co., Boston, Mass.

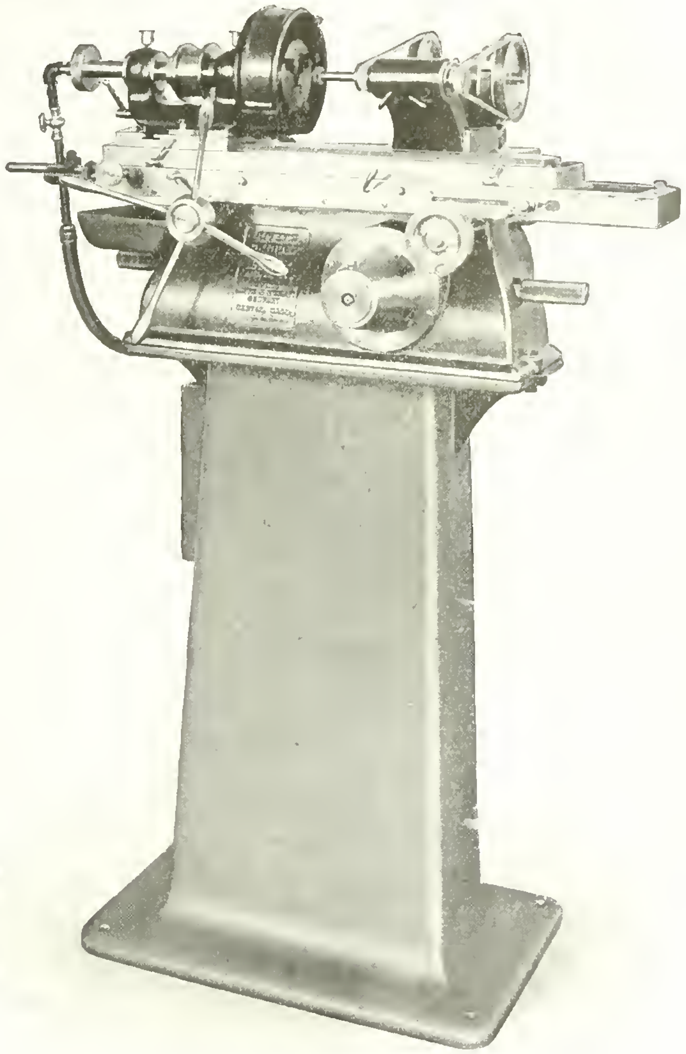
Grinders, Motor Driven.
Ford-Smith Machine Co., Hamilton, Ont.

Grinders, Pneumatic.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.

Grinders, Portable, Electric Hand, Tool, Post, Floor and Bench.
Baird Machine Co., Bridgeport, Conn.
A. R. Williams Machy. Co., Toronto.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Mussens, Limited, Montreal.
Norton Co., Worcester, Mass.
Standard Elec. Tool Co., Cincinnati, O.
United States Electrical Tool Co., Cincinnati.

Grinders, Swing, Portable, Electric.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Standard Elec. Tool Co., Cincinnati, O.
United States Electrical Tool Co., Cincinnati.

The Rivett No. 3 Internal Grinder With Water Attachment



This Machine is equipped with the Rivett High-Speed Spindle, running from 10,000 to 25,000 R.P.M., a speed equal to the highest obtained in outside grinding.

Holes ground on the Rivett Grinder are true, there is no bell-mouth.

Let us figure on your work.

RIVETT LATHE & GRINDER COMPANY

Brighton, Boston, Mass.

Grinders, Tool and Holders.
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Blount, J. G., & Co., Everett, Mass.
Ford-Smith Machine Co., Hamilton.
Foss & Hill Machy. Co., Montreal.
Rivett, Lathe & Grinder Co., Boston, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

Grinders, Universal, Plain.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.

Grinders, Vertical Surface.
Can. Fairbanks-Morse Co., Montreal.
Pratt & Whitney Co., Dundas, Ont.

Grinding and Polishing Machines, Portable, Pneumatic and Spring Frame.
Abbott Ball Co., Hartford, Conn.
Can. Fairbanks-Morse Co., Montreal.
Ford-Smith Machine Co., Hamilton.
Gardner, Robt. & Son, Montreal.
Garvin Machine Co., New York.
Gray Mfg. & Machine Co., Ltd., Toronto.
Hall & Sons, John H., Brantford.
Independent Pneumatic Tool Co., Chicago, Ill.
Ludw Leowe & Co., A. G., Berlin, Germany.
Niles-Bement-Pond Co., New York.
Stow Mfg. Co., Binghampton, N.Y.

Grinding Wheels.
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls.
Ford-Smith Machine Co., Hamilton.
Mussens Limited, Montreal.
Norton Co., Worcester, Mass.

Hack Saw Frames.
Ford-Smith Machine Co., Hamilton.
Mussens Limited, Montreal.
Simonds Mfg. Co., Fitchburg, Mass.

Hammers, Drop and Belt Driven.
Bliss, E. W., Co., Brooklyn, N.Y.
Canadian Billings & Spencer, Ltd., Welland.
Canada Mach. Corporation, Galt, Ont.
Erie Foundry Co., Erie, Pa.
A. B. Jardine & Co., Hespeler, Ont.
Mussens Limited, Montreal.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
Plessisville Foundry, Plessisville, Que.
Toledo Machine & Tool Co., Toledo.

Hammers, Pneumatic.
Independent Pneumatic Tool Co., Chicago.
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Mussens Limited, Montreal.

Hammers, Steam.
John Bertram & Sons Co., Dundas.
Canada Mach. Corporation, Galt, Ont.
Erie Foundry Co., Erie, Pa.
Mussens Limited, Montreal.
National Machine & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.

Hand Hoists & Trolleys.
Gray Mfg. & Machine Co., Ltd., Toronto.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Whiting Foundry Equipment Co., Harvey, Ill.
Mussens, Limited, Montreal.

Hangers.
Can. Bond Hanger & Coupling Co., Ltd., Alexandria, Ont.
Gardner, Robt. & Son, Montreal.
Gray Mfg. & Machine Co., Ltd., Toronto.
John Millen & Son, Ltd., Montreal.
The Smart-Turner Machine Co., Hamilton.

Heating Apparatus.
Sheldons Limited, Galt.

Hinge Machinery.
Baird Machine Co., Bridgeport, Conn.

Hinges.
London Bolt & Hinge Works, London, Ont.

Hobbing Machines.
Mussens Limited, Montreal.
Schuchardt & Schutte, Montreal.

Hoists, Self Landing and Self Delivery.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Hoisting and Conveying Machinery.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.
Owen Sound Iron Works Co., Owen Sound.
Whiting Foundry Equipment Co., Harvey, Ill.

Hoists, Chain, Electric and Pneumatic.
Gray Mfg. & Machine Co., Ltd., Toronto.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.

Hoists, Electric.
Northern Crane Works, Walkerville.
Mussens Limited, Montreal.
Whiting Foundry & Equipment Co., Harvey, Ill.

Hooks.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Hose Clamp Tool.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Hose, Linen, Underwriters.
F. Reddaway & Co., Montreal, P.Q.

Hose, Pneumatic.
Canadian Westinghouse Co., Hamilton.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago.

Hose, Steam, Suction and Water.
Can. H. W. John-Manville Co., Toronto.
Goodyear Tire & Rubber Co. of Canada, Toronto.

Holders for Dies and Drills.
Wells Brothers Company, Greenfield, Mass.

Hydraulic Accumulators.
Can. Fairbanks-Morse Co., Montreal.
Mussens Limited, Montreal.
Niles-Bement-Pond Co., New York.
The Smart-Turner Machine Co., Hamilton.

Hydraulic Machinery.
Mussens Limited, Montreal.
Niles-Bement-Pond Co., New York.
John Inglis Co., Toronto.
National Machinery & Supply Co., Hamilton.

Indicators, Speed.
L. S. Starrett Co., Athol, Mass.
Schuchardt & Schutte, Montreal.

Index Centres.
Garvin Machine Co., New York.

Iron Filler.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Iron Ore.
Hanna & Co., M. A., Cleveland, O.

Jacks.
Can. Fairbanks-Morse Co., Montreal.
Canadian Brake Shoe Co., Ltd., Sherbrooke, Que.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Mussens Limited, Montreal.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Plessisville Foundry, Plessisville, Que.

Jacks, Machinists.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Jacks, Pneumatic.
Northern Crane Works, Walkerville.

Jacks, Pit and Track.
Can. Fairbanks-Morse Co., Montreal.
Herbert Morris Crane & Hoist Co., Ltd. Toronto.
Northern Crane Works, Walkerville.

Japanning Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Jaws, Face Plate.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.

Jigs, Tools, etc.
Gray Mfg. & Machine Co., Ltd., Toronto.
Hamilton Gear & Machine Co., Toronto.
Windsor Machine & Tool Works, Windsor, Ont.

Key Seaters.
A. R. Williams Machy. Co., Toronto.
Garvin Machine Co., New York.
Mussens Limited, Montreal.

Kilns.
Sheldons, Limited, Galt, Ont.

Ladles, Foundry.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Lacquering Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Lag Screw Gimlet Pointers.
National Machy. Co., Tiffin, Ohio.

Lamps, Arc and Incandescent.
Can. Fairbanks-Morse Co., Montreal.
Can. H. W. Johns-Manville Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Ker & Goodwin, Brantford.

Lathe Chucks.
Ker & Goodwin, Brantford.
Rae Brothers, Hamilton, Ont.

Lathe Dogs and Attachments.
Armstrong Bros. Tool Co., Chicago.
Hendey Machine Co., Torrington, Conn.
J. H. Williams & Co., Brooklyn, N.Y.

Lathes, Bench.
W. F. & John Barnes Co., Rockford.
Blount, J. G., & Co., Everett, Mass.
Can. Fairbanks-Morse Co., Montreal.
Canada Mach. Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Pratt & Whitney Co., Dundas, Ont.
Rivett, Lathe & Grinder Co., Boston, Mass.

Lathes, Engine.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas
Can. Fairbanks-Morse Co., Montreal.
Canada Mach. Corp., Galt, Ont.
Cincinnati Iron & Steel Co., Cincinnati, O.
C. F. Dittes, Ltd., Gerdau, Saxony, Germany.
Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Hendey Machine Co., Torrington, Conn.
Foss & Hill Machy. Co., Montreal.
R. K. LeBlond Machine Tool Co., Cincinnati, O.
R. McDougall Co., Galt.
D. McKenzie Machinery Co., Guelph, Ont.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.

Lathes, Patternmakers'.
Mussens, Limited, Montreal.

Lathes, Screw Cutting.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas
Canada Mach. Corp., Galt, Ont.
Cincinnati Iron & Steel Co., Cincinnati, O.
R. K. LeBlond Machine Tool Co., Cincinnati, O.
Ludw. Loewe & Co., A-G, Berlin, Germany.
C. F. Dittes, Ltd., Gerdau, Saxony, Germany.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.
Schuchardt & Schutte, Montreal.

Lathes, Spinning.
Bliss, E. W., Co., Brooklyn, N.Y.
Toledo Mach. & Tool Co., Toledo, O.

Lathe, Turret and Speed.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas
Blount, J. G. & Co., Everett, Mass.
Can. Fairbanks-Morse Co., Montreal.
Canada Mach. Corp., Galt, Ont.
Cincinnati Iron & Steel Co., Cincinnati, O.
Garvin Machine Co., New York.
R. K. LeBlond Machine Tool Co., Cincinnati, O.
Ludw. Loewe & Co., A-G, Berlin, Germany.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Warner & Swasey Co., Cleveland, O.
Windsor Machine Co., Windsor, Vt.

Lifts, Pneumatic.
Whiting Foundry Equipment Co., Harvey, Ill.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Link Belting.
Can. Fairbanks-Morse Co., Montreal.
Jones & Glassco, Montreal.

Linoleum Mill Machinery.
Bertrams, Ltd., Edinburgh, Scotland.

Locks and Padlocks, etc.
Can. Yale & Towne, Ltd., St. Catharines, Ont.

Lockers.
Dennis Wire & Iron Works, London.

Locomotives, Electrical.
Canadian Westinghouse Co., Hamilton.

Locomotives, Industrial.
Mussens, Limited, Montreal.
National Machinery & Supply Co., Hamilton, Ont.

Locomotives, Turn Tables.
Can. Bridge Co., Walkerville, Ont.

Loose Pulleys.
American Pulley Company, Philadelphia.

Lubricants.
Railway Asbestos Packing Co., Sherbrooke, Que.

Lumber Measuring Machines.
Barley Bros., Stouffville, Ont.

Machine Divided Rules.
Lufkin Rule Co., Saginaw, Mich.

Machinery Dealers.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Mussens, Limited, Montreal.
Foss & Hill Machy. Co., Montreal.
National Machinery & Supply Co., Hamilton.
Schuchardt & Schutte, Toronto.

Machinery Guards.
Jones & Glassco, Montreal, P.Q.
A. R. Williams Machy. Co., Toronto.
Canada Wire Goods Mfg. Co., Hamilton.

Machinery Repairs.
Gray Mfg. & Machine Co., Ltd., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Plessisville Foundry, Plessisville, Que.

Machinists' Scales, Small Tools and Supplies.
Can. Fairbanks-Morse Co., Montreal.
Detroit Twist Drill Co., Detroit, Mich.
Frank H. Scott, Montreal.
J. H. Williams & Co., Brooklyn, N.Y.

Magnets, Lifting.
Schuchardt & Schutte, Toronto.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Mandrels.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.

Manufacturing Draftsmen.
Patent Selling & Manufacturing Agency, Toronto.

Measuring Tapes and Rules.
F. H. Scott, Montreal.
Lufkin Rule Co., of Canada, Windsor, Ont.

Mechanical Engineers.
Patent Selling & Mfg. Agency, Toronto.

Metal Spools.
American Pulley Company, Philadelphia.

Metallurgists.
Milton Hersey Co., Montreal.

Meters, Electrical.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Can. Westinghouse Co., Hamilton.

Mill Machinery.
Alexander Fleck, Ltd., Ottawa.

Milling Attachments.
John Bertram & Sons Co., Dundas
Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Cincinnati.
Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee.
Kempsmith Mfg. Co., Milwaukee, W.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.

Milling Machines, Horizontal and Vertical.
A. R. Williams Machy. Co., Toronto.
Brown & Sharpe Mfg. Co., Providence.
John Bertram & Sons Co., Dundas
Canada Mach. Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee.
Kempsmith Mfg. Co., Milwaukee, W.
R. K. LeBlond Machine Tool Co., Cincinnati, O.
Ludw. Loewe & Co., A-G, Berlin, Germany.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.

Milling Machines, Plain, Bench and Universal.
A. R. Williams Machy. Co., Toronto.
Canada Mach. Corp., Galt, Ont.
Cincinnati Milling Machine Co., Cincinnati.
Garvin Machine Co., New York.
Hendey Machine Co., Torrington.
Kearney & Trecker Co., Milwaukee.
Kempsmith Mfg. Co., Milwaukee, Wis
Ludw. Loewe & Co., A-G, Berlin, Germany.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Rivett, Lathe & Grinder Co., Boston, Mass.
Schuchardt & Schutte, Toronto.

Milling Machines, Profile.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Schuchardt & Schutte, Toronto.

Milling Tools.
Brown & Sharpe Mfg. Co., Providenca.
Canada Mach. Corp., Galt, Ont.
Geometric Tool Co., New Haven, Con.
Kempsmith Mfg. Co., Milwaukee, W.

Mine Cars and Hitchings.
Pratt & Whitney Co., Dundas, Ont.
Modern Tool Co., Erie, Pa.
Mussens, Limited, Montreal.
Can. Fairbanks-Morse Co., Montreal.

Mining Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Mussens, Limited, Montreal.
T. & H. Electric Co., Hamilton.

Mortising Machines.
Jones & Glassco, Montreal.

Motors, Electric.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can Westinghouse Co., Hamilton.
Hall Engineering Works, Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
T. & H. Electric Co., Hamilton.

Motors, Pneumatic.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago.
Mussens, Limited, Montreal.

Moulded Rubber Goods.
Goodyear Tire & Rubber Co., Toronto.

Multiple Index Centres.
Garvin Machine Co., New York.

Nickel-plating and Polishing.
Copp Stove Co., Fort William, Ont.

Nipple Threading Machines.
John H. Hall & Sons, Ltd., Brantford, Ont.
Landis Machine Co., Waynesboro, Pa.

Nozzles, Spray.
Can. Buffalo Forge Co., Montreal.

Nuts, Semi-Finish and Finished.
Canada Grip Nut Co., Montreal.
Galt Machine Screw Co., Galt, Ont.

Nut Locks.
Canada Grip Nut Co., Montreal.

Nuts and Railway Supplies.
Canada Grip Nut Co., Montreal.

Nut Burring Machines.
Mussens, Limited, Montreal.
National Machy. Co., Tiffin, O.
National Mach. & Sup. Co., Hamilton.

Nut Machines (Hot).
Mussens, Limited, Montreal.
National Machy. Co., Tiffin, O.

Nut Facing and Bolt Shaving Machines.
Garvin Machine Co., New York.
Mussens, Limited, Montreal.
National Machy. Co., Tiffin, O.
National Mach. & Sup. Co., Hamilton.

Nut Tappers.
John Bertram & Sons Co., Dundas.
Garvin Machine Co., New York.
Hall, J. H., & Son, Brantford, Ont.
A. B. Jardine & Co., Hespeler.
Landis Machine Co., Waynesboro, Pa.
Mussens, Limited, Montreal.
National Machy. Co., Tiffin, O.
National Mach. & Sup. Co., Hamilton.

Nut Wrenches.
Wells Brothers Co., Greenfield, Mass.

Oil Extractors.
Mussens, Limited, Montreal.

Oil Separators.
Can. Fairbanks-Morse Co., Montreal.
Mussens, Limited, Montreal.
Sheldons, Ltd., Galt, Ont.

Oil Stones.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.

Ovens for Baking, Bluing, Drying, Enameling, Japanning and Lacquering.
Gray Mfg. & Machine Co., Ltd., Toronto.
Oven Equipment & Mfg. Co., New Haven, Conn.

Oscillating Valve Grinders. (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Oxygen.
L'Air Liquide Society, Toronto.

Packing, Rubber, etc.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Goodyear Tire & Rubber Co. of Canada, Toronto.

Pans, Lathe.
Cleveland Wire Spring Co., Cleveland.

Pans, Steel Shop.
Cleveland Wire Spring Co., Cleveland.

Paper Mill Machinery.
Bertrams, Ltd., Edinburgh, Scotland.

Patent Experts.
Patent Selling & Mfg. Agency, Toronto.

Patent Solicitors.
H. J. S. Dennison, Toronto.
Egerton R. Case, Toronto.
Fetherstonhaugh & Co., Ottawa.
Lloyd Blackmore & Co., Ottawa.
Marion & Marion, Montreal.
Patent Selling & Manufacturing Agency, Toronto.
Ridout & Maybee, Toronto.
Van Hallen & O'Neail, Winnipeg.

Patterns.
Copp Stove Co., Fort William, Ont.
Galt Malleable Iron Co., Galt.
Gray Mfg. & Machine Co., Ltd., Toronto.
Guelph Pattern Works, Guelph.
Hamilton Pattern Works, Hamilton.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.
Toronto Pattern Works, Toronto.
Wells Pattern & Machine Works, Toronto.

Patterns, Metal and Wood.
Guelph Pattern Works, Guelph, Ont.

Pedestal Grinders.
Gray Mfg. & Machine Co., Ltd., Toronto.

Perforated Metals & Ornamental Iron Goods.
Canada Wire & Iron Goods Co., Hamilton.

Penstocks.
John Inglis Co., Toronto.

Phosphor Bronze Castings.
Tallman Brass & Metal Co., Hamilton.

Pig Iron.
Canada Iron Corp., Montreal.
Hanna & Co., M. A., Cleveland, O.
Stevens, F. B., Detroit, Mich.
Steel Co. of Canada, Hamilton.

Pipe Cutting and Threading Machines.
A. R. Williams Machy. Co., Toronto.
Armstrong Mfg. Co., Bridgeport, Conn.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Mussens, Limited, Montreal.
Williams Tool Co., Erie, Pa.

Pipe Cutters, Rolling.
Armstrong Mfg. Co., Bridgeport, Conn.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
John H. Hall & Sons, Ltd., Brantford, Ont.

Pipe (Second Hand)
Imperial Waste & Metal Co., Montreal

Pipe Straightening Machines.
Sleeper & Hartley, Worcester, Mass.

Planer Drives, Electrical.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Niles-Bement-Pond Co., New York.

Planer Jacks.
Armstrong Bros. Tool Co., Chicago.

Planers, Standard and Rotary.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Canada Mach. Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.
Schuchardt & Schutte, Toronto.

Planing and Shaping Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.

Planing Mill Exhausters.
Sheldons, Ltd., Galt, Ont.

Pliers.
Canadian Billings & Spencer, Ltd., Welland.
McKaig Drop Forge Co., Buffalo, N.Y.
Schuchardt & Schutte, Toronto.

Pneumatic Chain-Block.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Pneumatic Tools.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Independent Pneumatic Tool Co., Chicago, New York.
Mussens, Limited, Montreal.

Polishing Machines, Electric and Band.
Can. H. W. Johns-Manville Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

Power Plant Equipments.
Can. Fairbanks-Morse Co., Montreal.

Power Transmission.
American Pulley Co., Philadelphia.
The Smart-Turner Mach. Co., Hamilton

Press Screw (Adjustable).
W. F. & John Barnes Co., Rockford.

Presses, Bench Straightening.
Toledo Machine & Tool Co., Toledo.

Presses, Cam, Toggle, Eyelet.
Baird Machine Co., Bridgeport, Conn.
Toledo Machine & Tool Co., Toledo, O.

Presses, Broaching.
E. W. Bliss Co., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.

Presses, Arbor or Mandrel.
G. T. Eames Co., Kalamazoo, Mich.

Presses, Drop.
Baird Machine Co., Bridgeport, Conn.
W. H. Banfield & Son, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.

Presses, Forging.
Baird Machine Co., Bridgeport, Conn.
Erie Foundry Co., Erie, Pa.
E. W. Bliss Co., Brooklyn, N.Y.
Can. Fairbanks-Morse Co., Montreal.
John Inglis Co., Toronto.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
United Engineering & Foundry Co., Pittsburgh.

Presses, Hydraulic.
Henry Berry & Co., Ltd., Leeds, Eng.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas
Canada Mach. Corp., Galt, Ont.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
United Engineering & Foundry Co., Pittsburgh.

Presses, Pneumatic.
Toledo Machine & Tool Co., Toledo.

Presses, Power.
Baird Machine Co., Bridgeport, Conn.
A. R. Williams Machy. Co., Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Brown Boggs Co., Hamilton, Ont.
Canada Mach. Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Erie Foundry Co., Erie, Pa.
Mussens, Limited, Montreal.
Toledo Machine & Tool Co., Toledo.

Presses, Spring Foot.
Baird Machine Co., Bridgeport, Conn.
Toledo Machine & Tool Co., Toledo.

Pressure Gauges.
Thwing Instrument Co., Philadelphia, Pa.

Pressure Regulators.
Can. Fairbanks-Morse Co., Montreal.

Protective Paint.
Jos. Dixon Crucible Co., Jersey City.

Pulleys.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Gray Mfg. & Machine Co., Ltd., Toronto.
Positive Clutch & Pulley Works, Ltd., Toronto.
Schuchardt & Schutte, Montreal.
The Smart-Turner Mach. Co., Hamilton.

Pulley Blocks, Motor Driven.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Pulley Machinery, Drilling and Tapping.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
American Pulley Co., Philadelphia.

Pumping Machinery.
A. R. Williams Machy. Co., Toronto.
Canada Mach. Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Gray Mfg. & Machine Co., Ltd., Toronto.
Hall Engineering Wks., Montreal, Que.
Inglis Co., John, Toronto.
Mussens, Limited, Montreal.
National Mach. & Sup. Co. Hamilton.
Sherbrooke Mach. Co., Sherbrooke.
The Smart-Turner Mach. Co., Hamilton.

Pumps, all Kinds.
Owen Sound Iron Works Co., Owen Sound.
A. R. Williams Machy. Co., Toronto.
Gray Mfg. & Machine Co., Ltd., Toronto.

Pumps, Electrically Driven.
Henry Berry & Co., Ltd., Leeds, Eng.

Punches and Dies.
W. H. Banfield & Sons, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Gray Mfg. & Machine Co., Ltd., Toronto.
Scott Bros., Halifax, Eng.
Canada Mach. Corp., Galt, Ont.
Gardner, Robt., & Son, Montreal.
Globe Machine & Stamping Co.
A. B. Jardine & Co., Hespeler, Ont.
Mussens, Limited, Montreal.
Pratt & Whitney Co., Dundas, Ont.
Schuchardt & Schutte, Toronto.

Punches, Power.
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Canada Mach. Corp., Galt, Ont.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.
Schuchardt & Schutte, Toronto.

Punches, Pneumatic.
Jno. F. Allen Co., New York.

Punches, Turret.
Canada Mach. Corp., Galt, Ont.
Mussens, Limited, Montreal.

Punching Machines, Horizontal.
Bertrams, Ltd., Edinburgh, Scotland.
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Canada Mach. Corp., Galt, Ont.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.

Pyrometers and Thermometers.
Thwing Instrument Co., Philadelphia, Pa.

Quartering Machines.
Canada Mach. Corp., Galt, Ont.
John Bertram & Sons Co., Dundas.
Niles-Bement-Pond Co., New York.

Ratchet Wrenches.
Wells Brothers Co., Greenfield, Mass.

Rail Benders.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.

Railroad Tools.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.

Rails, Relaying.
Imperial Belting & Supply Co., Montreal.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Rammers, Bench and Floor.
Detroit Foundry Sup. Co., Windsor.
Guelph Pattern Works, Guelph, Ont.

Rapping Plates.
Detroit Foundry Sup. Co., Windsor.
Stevens, F. B., Detroit, Mich.

Raw Hide Pinions.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Mussens, Limited, Montreal.

Reamers, Adjustable.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Detroit Twist Drill Co., Detroit, Mich.
Morse Twist Drill & Machine Co., New Bedford.
Mussens, Limited, Montreal.
Pratt & Whitney Co., Dundas, Ont.
Schuchardt & Schutte, Montreal.
Wells Brothers Co., Greenfield, Mass.

Reamers, Bridge, Expanding and High Speed.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Detroit Twist Drill Co., Detroit, Mich.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Reamer Fluting Machines.
Garvin Machine Co., New York.

Reamers, Pipe, Cylinder and Locomotive.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Reaming Machines, Pneumatic.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago.

Reamers, Steel Taper and Self-feeding.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Mussens, Limited, Montreal.
Pratt & Whitney Co., Dundas, Ont.

Recording Instruments.
Thwing Instrument Co., Philadelphia, Pa.

Reels.
American Pulley Co., Philadelphia.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Rheostats.
Can. Westinghouse Co., Hamilton.
Hall Engineering Wks., Montreal.
T. & H. Electric Co., Hamilton.
Northern Bolt & Screw Co., Owen Sound.

Rivet Machines.
Brand Ed., Victoria St., London, Eng.
Mussens, Limited, Montreal.
National Machinery Co., Tiffin, O.

Rivets, Tubular, Bifurcated and Putty.
Parmenter & Bulloch Co., Gananoque.

Riveters, Pneumatic, Hydraulic.
Jno. F. Allen Co., New York.
Henry Berry & Co., Ltd., Leeds, Eng.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co Chicago, Ill.
Mussens, Limited, Montreal.
National Mach. & Sup. Co., Hamilton.
Niles-Bement-Pond Co., New York.

Riveting Machines, Elastic Rotary Blow.
F. B. Shuster Co., New Haven, Conn.

Rolls, Bending.
John Bertram & Sons Co., Dundas.
Canada Mach. Corp., Galt, Ont.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.

Roofing.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Rope.
Scythes & Co., Toronto.

Rope Blocks.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Rotary Converters.
A. R. Williams Machy. Co., Toronto.
Can. Westinghouse Co., Hamilton.
Toronto and Hamilton Electric Co., Hamilton.

Rubber Mill Machinery.
Bertrams, Ltd., Edinburgh, Scotland.

Runways, Electric and Hand.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Safety Engineering, Accident and Fire Prevention.
Can. Safety Engineering Bureau, Toronto.

Safety Set Screws.
Allen Mfg. Co., Inc., Hartford, Conn.

Sand Blasts.
Curtis Pneumatic Machinery Co., St. Louis, Mo.

Steel Pulleys.
American Pulley Co., Philadelphia.

Saw Mill Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Gardner, Robt., & Son, Montreal.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Foss & Hill Machy. Co., Montreal.
Mussens, Limited, Montreal.
National Mach. & Sup. Co., Hamilton.
Plessisville Foundry, Plessisville, Que.

Saws, Inserted Tooth.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hack.
Can. Fairbanks-Morse Co., Montreal.
Canada Mach. Corp., Galt, Ont.
Diamond Saw & Stamping Works, Buffalo.
Ford-Smith Machine Co., Hamilton, Ont.
Foss & Hill Machy. Co., Montreal.
Garvin Machine Co., New York.
Hermann Boker & Co., Montreal.
D. McKenzie Mach. Co., Guelph, Ont.
John Millen & Son, Montreal.
L. S. Starrett Co., Athol, Mass.
Mussens, Limited, Montreal.
Victor Saw Works, Ltd., Hamilton.

Saws, Circular Metal.
Simonds Mfg. Co., Fitchburg, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

Screws.
Northern Bolt & Screw Co., Owen Sound.
Fisher Motor Co., Walkerville, Ont.

Screws, Caps and Set.
Galt Machine Screw Co., Galt.

Screw Machine Products.
Galt Machine Screw Co., Galt.

Screw Machines, Hand .Automatic.
Brand, Ed., Victoria St., London. Eng.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Garvin Machine Co., New York.
A. B. Jardine & Co., Hespeler.
Ludw. Loewe & Co., A. G., Berlin, Germany.
Mussens, Limited, Montreal.
National Mach. & Sup. Co., Hamilton.
Pratt & Whitney Co., Dundas, Ont.
Warner & Swasey Co., Cleveland, O.
Windsor Machine Co., Windsor, Vt.

Screw Machines, Multiple Spindle.
Mussens, Limited, Montreal.
Windsor Machine Co., Windsor, Vt.

Screw Plates.
Butterfield & Co., Rock Island, Que.
Can. Tap & Die Co., Galt, Ont.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Machine Co., New Bedford.
Wells Bros. Co., Greenfield, Mass.
Wiley & Russell Co., Greenfield, Mass.

Screw Slotters.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Simonds Mfg. Co., Fitchburg, Mass.

Seamless Steel Tubes.
John Millen & Son, Ltd., Montreal.

Shafting.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Gardner, Robt., & Son, Montreal.
Can. Drawn Steel Co., Hamilton, Ont.
Gardner, Robt., & Son, Montreal.
Gray Mfg. & Machine Co., Ltd., Toronto.
National Mach. & Sup. Co., Hamilton.
Niles-Bement-Pond Co., New York.
Plessisville Foundry, Plessisville, Que.
The Smart-Turner Machine Co., Hamilton.
Union Drawn Steel Co., Hamilton.

Shanks, Straight and Taper.
Jacobs Mfg. Co., Hartford, Conn.

Shapers.
John Bertram & Sons Co., Dundas
Canada Mach. Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Gardner, Robt., & Son, Montreal.
Hendey Machine Co., Torrington, C.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.

Sharpening Stones.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.

Shavings, Separators.
Sheldons, Ltd., Galt, Ont.

Shear-Legs.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Shearing Machines, Angle Iron, Bar and Gate.
John Bertram & Sons Co., Dundas
Bertrams, Ltd., Edinburgh, Scotland.
Canada Mach. Corp., Galt, Ont.
A. B. Jardine & Co., Hespeler.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.
Scott Bros., Halifax, Eng.
Schuchardt & Schutte, Toronto.
Toledo Machine & Tool Co., Toledo.

Shears, Power.
John Bertram & Sons Co., Dundas
Bliss, E. W., Co., Brooklyn, N.Y.
Mussens, Limited, Montreal.
National Machy. Co., Tiffin, Ohio.
National Mach. & Sup. Co., Hamilton.
Niles-Bement-Pond Co., New York.
Schuchardt & Schutte, Toronto.
Toledo Mach. & Tool Co., Toledo, O.

Shears, Pneumatic.
John F. Allen Co., New York.
Toledo Mach. & Tool Co., Toledo, O.

Shears, Squaring.
Brown, Boggs Co., Hamilton, Ont.
Erie Foundry Co., Erie, Pa.

Sheet Metal Working Tools.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Hamilton, Ont.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Shovels, Steam, Electric.
Mussens, Limited, Montreal.

Side Tools.
Armstrong Bros. Tool Co., Chicago.

Silver Lead.
Detroit Foundry Sup. Co., Windsor.

Slings.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Slotters.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.

Smokestacks.
John Inglis Co., Toronto.
Plessisville Foundry, Plessisville, Que.

Sockets.
Cleveland Twist Drill Co., Cleveland.
Detroit Twist Drill Co., Detroit, Mich.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.

Soldering Irons.
Brown, Boggs Co., Hamilton, Ont.

Solders.
Tallman Brass & Metal Co., Hamilton.

Speed Recorder.
Thwing Instrument Co., Philadelphia, Pa.

Special Machinery.
Armstrong Bros., Toronto.
W. H. Banfield & Sons, Toronto.
John Bertram & Sons Co., Dundas.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W. Co., Brooklyn, N.Y.
Brown, Boggs Co., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Canada Mach. Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton.
Gray Mfg. & Machine Co., Ltd., Toronto.
Garvin Machine Co., New York.
John H. Hall & Sons, Brantford.
Jardine, A. B., & Co., Hespeler.
D. McKenzie Machinery Co., Guelph, Ont.
National Mach. & Sup. Co., Hamilton.
Rae Brothers, Hamilton, Ont.
Sleeper & Hartley, Worcester, Mass.
Peacock Bros., Montreal.
Plessisville Foundry, Plessisville, Que.

Spike Machines.
The Smart-Turner Machine Co., Hamilton.

Spring Coilers.
Garvin Machine Co., New York.
Sleeper & Hartley, Worcester, Mass.

Springs, Machinery.
Cleveland Wire Spring Co., Cleveland.

Spring Making Machinery (Automatic).
Sleeper & Hartley, Worcester, Mass.

Sprockets, Chain.
Morse Chain Co., Ithaca, N.Y.

Stamping.
Homer & Wilson, Hamilton, Ont.

Stamping Machinery.
Homer & Wilson, Hamilton, Ont.
Brown, Boggs Co., Ltd., Hamilton.

Stand Pipes.
John Inglis Co., Toronto.

Staple Machines.
Sleeper & Hartley, Worcester, Mass.

Stay-Bolt Driver.
Independent Pneumatic Tool Co., Chicago.

Steam Specialties.
Sheldons, Ltd., Galt, Ont.

Steam Separators and Traps.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton.
Martin & Co., W. A., Toronto.

Steel Chains for Pulp Mill and Saw Mill.
Plessisville Foundry, Plessisville, Que.

Steel Bending Brakes.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Steel, Cold Rolled.
Can. Drawn Steel Co., Hamilton, Ont.

Steel, Nickel Chrome.
Schuchardt & Schutte, Toronto.

Steel Pressure Blowers.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Sash Pulleys.
American Pulley Co., Philadelphia.

Steel, all kinds.
Can. Bridge Co., Walkerville, Ont.

Steel, High Speed.
Armstrong Whitworth of Canada, Ltd., Montreal.
Herman Boker & Co., Montreal.
Thos. Firth & Sons, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Mussens, Limited, Montreal.
National Mach. & Sup. Co., Hamilton.

Stocks for Dies.
Wells Bros. Co., Greenfield, Mass.

Stocks, Pipe.
John Inglis Co., Toronto.
Butterfield & Co., Rock Island, Que

Straight Edges.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Straightening Machinery.
Bertrams, Ltd., Edinburgh, Scotland.
Mussens, Limited, Montreal.
National Mach. & Sup. Co., Hamilton.
Sleeper & Hartley, Worcester, Mass.

Studs.
Galt Machine Screw Co., Galt, Ont.

Switchboards.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Can. Westinghouse Co., Hamilton.
Hall Engineering Works, Montreal.
Toronto & Hamilton Electric Co. Hamilton.

Switches, Railway.
National Mach. & Sup. Co., Hamilton.

Tanks, Steel.
John Inglis Co., Toronto.
Plessisville Foundry, Plessisville, Que.

Tapes, Friction.
Can. H. W. Johns Manville Co., Ltd., Toronto.

Trapping Machines (Pneumatic)
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.

Tapping Machines and Attachments.
John Bertram & Sons Co., Dundas
Canada Mach. Corp., Galt, Ont.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Mussens, Limited, Montreal.
Niles-Bement-Pond Co., New York.
L. S. Starrett Co., Athol, Mass.

Hap Chucks.
Wells Bros. Co., Greenfield, Mass.

Taps, Adjustable.
Geometric Tool Co., New Haven, C.

Taps, Dies and Wrenches.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Can. Tap & Die Co., Galt, Ont.
Cleveland Twist Drill Co., Cleveland.
Detroit Twist Drill Co., Detroit, Mich.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Machine Co., New Bedford.
Mussens, Limited, Montreal.
Pratt & Whitney Co., Dundas, Ont.
Preston & Schwartz, Galt, Ont.
L. S. Starrett Co., Athol, Mass.
Wiley & Russell Co., Greenfield, Mass.
Wells Brothers Co., Greenfield, Mass.

Technical Books.
American School of Correspondence, Chicago.

Telphers.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Tents and Awnings.
Scythes & Co., Toronto.

Testing Laboratories.
Toronto Testing Laboratory, Toronto.

Thread Cutting Machines.
Can. Fairbanks-Morse Co., Montreal.
Garvin Machine Co., New York.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
National Machy. Co., Tiffin, Ohio.
Wiley & Russell Co., Greenfield, Mass.

Tinsmiths' Tools.
Brown, Boggs Co., Hamilton, Ont.
Steel Bending Brake Works Ltd., Chatham, Ont.

Tire, Wheels.
Wells Bros. Co., Greenfield, Mass.

Tool Holders.
Armstrong Bros. Tool Co., Chicago.
Cleveland Twist Drill Co., Cleveland.
Detroit Twist Drill Co., Detroit, Mich.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.

Tool Room Partitions.
Can. Wire & Iron Goods Co., Hamilton.

Tool Posts, Lathe.
Armstrong Bros. Tool Co., Chicago.

Tool Steel.
Armstrong, Whitworth, Ltd., of Canada, Montreal.
Herman Boker & Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Thos. Firth & Sons, Montreal.
Mussens, Limited, Montreal.
National Mach. & Sup. Co., Hamilton

Tool Steel Tubing.
John Millen & Son Ltd Montreal.

Tools, Blacksmith's.
A. R. Williams Machy. Co., Toronto.

Tools, Electrical.
A. R. Williams Machy. Co., Toronto.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Mussens, Limited, Montreal.

Tool Work.
Homer & Wilson, Hamilton, Ont.

Tools, Lathe, Planer and Slotter.
Armstrong Bros. Tool Co., Chicago.
Rivett Lathe & Grinder Co., Boston, Mass.

Torches, Steel.
Detroit Foundry Sup. Co., Windsor.
Stevens, F. B., Detroit, Mich.
Armstrong, Whitworth of Canada, Ltd., Montreal.

Track Jacks.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Track Systems.
Herbert Morris Craine & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Track Tools.
Can. H. W. Johns-Manville Co., Ltd.,
Can. Fairbanks Morse Co., Montreal.

Transformers and Converters.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Westinghouse Co., Hamilton.
Hall Engineering Works, Montreal.
T. & H. Electric Co. Hamilton.

Transmission Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Drawn Steel Co., Hamilton, Ont.
Hamilton Gear & Mach. Co., Toronto.
John Inglis Co., Toronto.
Jones & Glassco, Montreal.
Morse Chain Co., Ithaca, N.Y.
Mussens, Limited, Montreal.
Plessisville Foundry, Plessisville, Que.
The Smart-Turner Machine Co., Hamilton.

Transmission Towers.
Can. Bridge Co., Walkerville, Ont.
Canadian Ingersoll-Rand Co., Ltd., Montreal.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Detroit Foundry Sup. Co., Windsor, Ont.
Dominion Fdry. Supply Co., Toronto.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton

Traveling Cranes.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Trolley Hoists, Electric.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Trucks, Lumber and Kiln.
John Inglis Co., Toronto.
Sheldons, Ltd., Galt, Ont.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.

Trucks, Factory, Freight, Etc.
Gray Mfg. & Machine Co., Ltd., Toronto.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Tube Expanders (Rollers).
A. B. Jardine & Co., Hespeler.

Tube Straightening Machines (Automatic).
Sleeper & Hartley, Worcester, Mass.

Tubing, Seamless Steel.
John Millen & Son, Ltd., Montreal.

Tumbling Barrels.
Baird Machine Co., Bridgeport, Conn.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Turnbuckles.
Canadian Billings & Spencer, Ltd., Welland.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Turret Machines.
Pratt & Whitney, Hartford, Conn.

Turbines, Steam, Water.
John Inglis Co., Toronto.
Martin & Co., W. A., Toronto.
Plessisville Foundry, Plessisville, Que.
Can. Westinghouse Co., Hamilton.

Twine and Cordage.
Scythes & Co., Ltd., Toronto.

Upsetting and Bending Machinery.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas.
Canada Mach. Corp., Galt, Ont.
A. B. Jardine & Co., Hespeler.
Mussens, Limited, Montreal.
National Machy. Co., Tiffin, O.
Niles-Bement-Pond Co., New York.

Vacuum Pumps.
John Inglis Co., Toronto.

Valve Grinders (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Goodyear Tire & Rubber Co., Toronto.

Valve Milling Machines.
Barkey Bros., Stouffville, Ont.

Valves, Back Pressure, Steam.
Sheldons, Limited, Galt.

Ventilating Apparatus.
A. R. Williams Machy. Co., Toronto.
Sheldons, Limited, Galt.

Vises, Bench.
Chas. Parker & Co., Meriden, Conn.
Foss & Hill Machy. Co., Montreal.
National Mach. & Sup. Co., Hamilton.

Vises, Pipe.
Armstrong Mfg. Company, Bridgeport, Conn.
Chas. Parker & Co., Meriden, Conn.
National Mach. & Sup. Co., Hamilton.

Vises, Planer and Shaper.
National Mach. & Sup. Co., Hamilton.
Skinner Chuck Co., New Britain, C.

Vises, Milling Machine.
National Mach. & Sup. Co., Hamilton.
Schuchardt & Schutte, Montreal.

Washers.
London Bolt & Hinge Works, London, Ont.

Washer Machines.
National Machy. Co., Tiffin, Ohio.

Waste and Wipes.
Imperial Belt & Sup. Co., Montreal.
Scythes & Co., Ltd., Toronto.

Waterproof Coating, Cement, Fabric.
Can. H. W. Johns-Manville Co., Ltd. Toronto.

Watchman's Clocks.
A. R. Williams Machy. Co., Toronto.
General Fire Equipment Co., Toronto.

Welding and Cutting Clamps.
L'Air Liquide Society, Toronto.

Welding and Cutting Work.
Can. Blaugas Co., Montreal.
L'Air Liquide Society, Toronto.
Metals Welding Co., Cleveland, O.

Welding, Autogenous.
L'Air Liquide Society, Toronto.

Welding, Acetylene and Oxygen.
L'Air Liquide Society, Toronto.
Metals Welding Co., Cleveland, O.

Welding Plates.
Phillips-Lafitte Co., Philadelphia.

Welding Compounds.
Phillips-Lafitte Co., Philadelphia.

Welding Machines, Electric, etc.
Fisher Motor Co., Walkerville.
Tabor Mfg. Co., Philadelphia, Pa.

Wheelbarrows.
Mussens, Limited, Montreal.

Winches.
John H. Hall & Sons, Brantford.
Mussens, Limited, Montreal.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.

Window Wire Guards.
Canada Wire & Iron Goods Co., Hamilton.
B. Greening Wire Co., Hamilton, Ont.

Wire, all kinds.
Northern Bolt & Screw Co., Owen Sound, Ont.

Wire Chains.
B. Greening Wire Co., Hamilton, Ont.

Wire Cloth and Perforated Metals.
Canada Wire & Iron Goods Co., Hamilton.
Dennis Wire & Iron Works Co., Ltd., London.

Wire Forming and Stamping Machinery.
F. B. Shuster Co., New Haven, Conn.
Baird Machine Co., Bridgeport, Conn.
Brand, Ed., Victoria St., London, Eng.
Sleeper & Hartley, Worcester, Mass.

Wire Coiling and Wire Pointing Machinery.
Sleeper & Hartley, Worcester, Mass.

Wire Guards and Railings.
Canada Wire & Iron Goods Co., Hamilton, Ont.

Wire Nails.
Parmenter & Bulloch Co., Gananoque.
Steel Co. of Canada, Hamilton.

Wire Nail Machinery.
Brand, Ed., Victoria St., London, Eng.
National Machy. Co., Tiffin, Ohio.
Sleeper & Hartley, Worcester, Mass.
A. R. Williams Machy. Co., Toronto.

Wire Rope.
Mussens, Limited, Montreal.

Wire Straighteners and Cutters.
Baird Machine Co., Bridgeport, Conn.
Brand, Ed., Victoria St., London, Eng.
F. B. Shuster Co., New Haven, Conn.

Wire Coiling and Pointing Machines.
Baird Machine Co., Bridgeport, Conn.
F. B. Shuster Co., New Haven, Conn.

Wood Boring Machines.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.
Mussens, Limited, Montreal.

Woodworking Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Mussens, Limited, Montreal.
Plessisville Foundry, Plessisville, Que.

Wrenches.
Butterfield & Co., Rock Island, Que.
Canadian Billings & Spencer, Ltd., Welland.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wells Bros. Co., Greenfield, Mass.

Wrenches, Automobile Narrow Jaw and Monkey.
Bemis & Call Hardware & Tool Co., Springfield, Mass.
Trimont Mfg. Co., Roxbury, Mass.

Wrenches, Pipe, Monkey.
Bemis & Call Hardware & Tool Co., Springfield, Mass.
Trimont Mfg. Co., Roxbury, Mass.

Wrenches, Ratchet and Basin.
Bemis & Call Hardware & Tool Co., Springfield, Mass.

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Stuart Machinery Co., Winnipeg.
E. J. Woodison Co., Toronto.

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W. D. Beath & Son, Toronto.

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Abbott Ball Co., Hartford, Conn.
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Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
Northern Crane Works, Ltd., Walkerville, Ont.
E. J. Woodison Co., Toronto.
Whiting Foundry Equipment Co., Harvey, Ill.

Boiler Graphite.
Joseph Dixon Crucible Co., Jersey City, N.J.

Blowers.
A. R. Williams Machy. Co., Toronto.
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Can. Hanson & Van Winkle Co., Toronto.
Canadian Ingersoll-Rand Co., Ltd., Montreal.
Columbian Facing Mills Co., Buffalo.
Dominion Fdry. Sup. Co., Montreal.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
J. W. Paxson Co., Philadelphia, Pa.
W. S. Rockwell Co., New York.
Sheldons, Limited, Galt, Ont.
Stuart Machinery Co., Winnipeg.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Blast Gauges—Cupola.
Can. Hanson & Van Winkle Co., Toronto.
Columbian Facing Mills Co., Buffalo.
Dominion Fdry. Sup. Co., Montreal.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
Sheldons, Limited, Galt, Ont.
Frederic B. Stevens, Detroit.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Brass Melting Furnaces.
Can. Hanson & Van Winkle Co., Toronto.
Columbian Facing Mills Co., Buffalo.
Dominion Fdry. Sup. Co., Montreal.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
J. W. Paxson Co., Philadelphia, Pa.
W. S. Rockwell Co., New York.
Frederic B. Stevens, Detroit.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison & Co., Toronto.

Brushes, Foundry and Core.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Montreal.
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Manufacturers Brush Co., Cleveland, O.
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Osborn Mfg. Co., Cleveland, O.
J. W. Paxson Co., Philadelphia, Pa.
Frederic B. Stevens, Detroit.
E. J. Woodison & Co., Toronto.

Buffing and Polishing Machinery.
Ford-Smith Machine Co., Hamilton, Ont.
Chas. J. Menzemer, Niagara Falls, Ont.
W. W. Wells, Toronto.

Buffing and Polishing Compositions.
W. W. Wells, Toronto.

Buffs.
Chas. J. Menzemer, Niagara Falls, Ont.
W. W. Wells, Toronto.

Burners, Core Oven.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Montreal.
Federal Fdry. Supply Co., Cleveland.
Monarch Eng & Mfg. Co., Baltimore.
W. S. Rockwell Co., New York.
Frederic B. Stevens, Detroit.
E. J. Woodison Co., Toronto.

Cars, Core Oven.
Can. Hanson & Van Winkle Co., Toronto.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison & Co., Toronto.
Dominion Fdry. Sup. Co., Montreal.
J. S. McCormick Co., Pittsburg, Pa.
Federal Fdry. Supply Co., Cleveland.
Monaroh Eng & Mfg. Co., Baltimore.

Castings, Malleable.
Can. Malleable Iron Co. Owen Sound.

Cast Iron.
Frankel Bros., Toronto.

Castings, Aluminum and Brass.
F. W. Quinn, Hamilton, Ont.

Castings, Nickel.
W. W. Wells, Toronto.

Cars, Foundry.
Can. Hanson & Van Winkle Co., Toronto.
Detroit Fdry. Supply Co., Windsor, Ont.
Dominion Fdry. Sup. Co., Montreal.
J. S. McCormick Co., Pittsburg, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
Frederic B. Stevens, Detroit.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Chain Blocks.
Herbert Morris Chain & Hoist Co., Ltd., Toronto.
John Millen & Son, Ltd., Montreal.

Chaplets.
Columbian Facing Mills Co., Buffalo, N.Y.
J. S. McCormick Co., Pittsburg, Pa.
Wells Pattern & Machine Works, Limited, Toronto.

Charcoal.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Montreal.
Frederic B. Stevens, Detroit.
E. J. Woodison Co., Toronto.

Chemicals.
Chas. J. Menzemer, Niagara Falls, Ont.
W. W. Wells, Toronto.

Clay Lined Crucibles.
McCulloch-Dalzell Crucible Company, Pittsburg, Pa.

Core Binders.
Detroit Fdry. Supply Co., Windsor, Ont.
Federal Fdry. Supply Co., Cleveland.
J. S. McCormick, Pittsburg, Pa.
J. W. Paxson Co., Philadelphia, Pa.
Robeson Process Co., New Pennington, N.J.
E. J. Woodison Co., Toronto.

Core Box Machines.
Dominion Fdry. Sup. Co., Montreal.
J. S. McCormick, Pittsburg, Pa.
J. W. Paxson Co., Philadelphia, Pa.
E. J. Woodison Co., Toronto.

Core Cutting-off and Coning Machine.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
E. J. Woodison Co., Toronto.

Core Compounds.
Can. Hanson & Van Winkle Co., Toronto.
Columbian Facing Mills Co., Buffalo, N.Y.
Dominion Fdry. Sup. Co., Toronto.
J. S. McCormick, Pittsburg, Pa.
Federal Fdry. Sup. Co., Cleveland.
J. W. Paxson Co., Philadelphia, Pa.
Robeson Process Co., Pennington, N.J.
Frederic B. Stevens, Detroit.
E. J. Woodison Co., Toronto.

Core Machines, Hammer.
Brown Specialty Machinery Co., Chicago, Ill.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.

Core-making Machines.
Berkshire Mfg. Co., Cleveland, O.
Can. Hanson & Van Winkle Co., Toronto.
Columbian Facing Mills Co., Buffalo, N.Y.
Detroit Foundry Supply Co., Windsor, Ont.
J. S. McCormick Co., Pittsburg, Pa.
Federal Fdry. Sup. Co., Cleveland.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.
E. J. Woodison Co., Toronto.

Core Oils.
Cataract Refining Co., Buffalo, N.Y.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Holland Core Oil Co., Chicago.
J. S. McCormick Co., Pittsburg, Pa.
Federal Fdry. Sup. Co., Cleveland.
E. J. Woodison Co., Toronto.

Core Ovens.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
J. S. McCormick Co., Pittsburg, Pa.
Federal Fdry. Sup. Co., Toronto.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Eng. & Mfg. Co., Baltimore.
Oven Equipment & Mfg. Co., New Haven, Conn.
Sheldons, Limited, Galt, Ont.
Stevens, F. B., Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Core Wash.
Columbian Facing Mills Co., Buffalo, N.Y.
J. S. McCormick Co., Pittsburg, Pa.

Core Wax.
United Compound Co., Buffalo, N.Y.
W. D. Beath & Son, Toronto.
J. S. McCormick Co., Pittsburg, Pa.

Cranes, Travelling and Jib.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Northern Crane Works, Ltd., Walkerville, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Electric and Hand Power.
A. R. Williams Machy. Co., Toronto.
Dominion Bridge Co., Montreal.
Dominion Fdry. Sup. Co., Montreal.
Mussens, Limited, Montreal.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Ltd., Walkerville, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Cranes, Hydraulic.
Dominion Fdry. Sup. Co., Montreal.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Crucibles.
Can. Hanson & Van Winkle Co., Toronto.
Dixon Crucible Co., Joseph, Jersey City, N.J.
Dominion Fdry. Sup. Co., Montreal.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Seidel, R. B., Philadelphia.
Stevens, F. B., Detroit, Mich.
E. J. Woodison Co., Toronto.
J. S. McCormick Co., Pittsburg, Pa.
McCulloch-Dalzell Crucible Company, Pittsburg, Pa.

Cupolas.
A. R. Williams Machy. Co., Toronto.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Montreal.
Federal Fdry. Sup. Co., Cleveland.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
Monarch Eng. & Mfg. Co., Baltimore, Md.
Northern Crane Works, Ltd., Walkerville, Ont.
J. W. Paxson Co., Philadelphia, Pa.
Elk Fire Brick Co., Hamilton, Ont.
Sheldons, Limited, Galt, Ont.
Stevens, F. B., Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Cupola Blast Gauges.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. W. Paxson Co., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Cupola Blast Piping.
Toronto Blower Co., Toronto.

Cupola Blocks.
Pauley & Son, R., Toronto.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Elk Fire Brick Co., Hamilton, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.
E. J. Woodison Co., Toronto.

Cupola Blowers.
Can. Buffalo Forge Co., Montreal.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
J. S. McCormick Co., Pittsburg, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
Sheldons, Limited, Galt, Ont.
Stevens, F. B., Detroit, Mich.
E. J. Woodison Co., Toronto.

Cupola Linings.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Elk Fire Brick Co., Hamilton, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.
Stuart Machinery Co., Winnipeg.
E. J. Woodison Co., Toronto.

Cupola Twyers.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
J. S. McCormick Co., Pittsburg, Pa.
J. W. Paxson Co., Philadelphia, Pa. Toronto.
E. J. Woodison Co., Toronto.

Cutting-off Machines.
Dominion Fdry. Sup. Co., Toronto.
E. J. Woodison Co., Toronto.

Cyanide of Potassium.
Chas. J. Menzemer, Niagara Falls, Ont.
J. S. McCormick Co., Pittsburg, Pa.
W. W. Wells, Toronto.

Drying Ovens for Cores.
Oven Equipment & Mfg. Co., New Haven, Conn.
Whiting Foundry Equipment Co., Harvey, Ill.

Dry Kiln Equipment.
Corbett Fdry. & Machine Co., Owen Sound, Ont.

Drysand.
Columbia Facing Mills Co., Buffalo, N.Y.

Dynamos.
Chas. J. Menzemer, Niagara Falls, Ont.
W. W. Wells, Toronto.

Elevators, Foundry, Hydraulic, Pneumatic.
A. R. Williams Machy. Co., Toronto.
W. D. Beath & Son, Toronto.
Canadian Ingersoll-Rand Co., Ltd., Montreal.
J. S. McCormick Co., Pittsburg, Pa.
Scholfield Holden Machine Co., Ltd., Toronto.
Dominion Fdry. Sup. Co., Toronto.
E. J. Woodison Co., Toronto.

Emery Stands.
Ford-Smith Machine Co., Hamilton, Ont.

Fans, Exhaust.
Can. Buffalo Forge Co., Montreal.
Can. Hanson & Van Winkle Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Dominion Fdry. Sup. Co., Toronto.
J. S. McCormick Co., Pittsburg, Pa.
Stevens, Frederic B., Detroit.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Sheldons, Limited, Galt, Ont.
Stuart Machinery Co., Winnipeg.
E. J. Woodison Co., Toronto.

Fillers (Metallic).
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Federal Fdry. Supply Co., Cleveland.
Stevens, Frederic B., Detroit.
Shelton Metallic Filler Co., Derby, Conn.
E. J. Woodison Co., Toronto.

Fillets, Leather & Wooden.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Federal Fdry. Sup. Co., Cleveland.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
E. J. Woodison Co., Toronto.

Fire Brick and Clay.
Bailey & Son, R., Toronto.
Can. Hanson & Van Winkle Co., Toronto.
Columbian Facing Mills Co., Buffalo, N.Y.
Elk Fire Brick Co., Hamilton, Ont.
Dominion Fdry. Sup. Co., Toronto.
Federal Fdry. Sup. Co., Cleveland.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit.
Stuart Machinery Co., Winnipeg.
E. J. Woodison Co., Toronto.
Whitehead Bros. Co., Buffalo, N.Y.

Fire Sand.
Whitehead Bros. Co., Buffalo, N.Y.

Flasks, Snap, Etc.
Berkshire Mfg. Co., Cleveland, O.
Dominion Fdry. Sup. Co., Toronto.
Can. Hanson & Van Winkle Co., Toronto.
Columbian Facing Mills Co., Buffalo, N.Y.
Federal Fdry. Sup. Co., Cleveland.
Guelph Pattern Works, Guelph, Ont.
J. S. McCormick Co., Pittsburg, Pa.
J. W. Paxson Co., Philadelphia, Pa.
Sterling Wheelbarrow Co., West Allis, Wis.
E. J. Woodison Co., Toronto.

Foundry Coke.
Baird & West, Detroit.
Stevens, Frederic B., Detroit.
E. J. Woodison Co., Toronto.

Foundry Equipment.
A. R. Williams Machy. Co., Toronto.
W. D. Beath & Son, Toronto.
Can. Hanson & Van Winkle Co., Toronto.
Columbian Facing Mills Co., Buffalo, N.Y.
Federal Fdry. Sup. Co., Cleveland.
Dominion Fdry. Sup. Co., Toronto.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
Northern Crane Works, Walkerville, Ont.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit.
Stuart Machinery Co., Winnipeg.
Sterling Wheelbarrow Co., West Allis, Wis.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Foundry Parting.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Federal Fdry. Sup. Co., Cleveland.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit.
E. J. Woodison Co., Toronto.
Whitehead Bros. Co., Buffalo, N.Y.

Foundry Facings.
Can. Hanson & Van Winkle Co., Toronto.
J. S. McCormick Co., Pittsburg, Pa.
Columbian Facing Mills Co., Buffalo, N.Y.
Dominion Fdry. Sup. Co., Toronto.
Federal Fdry. Sup. Co., Cleveland.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Monarch Eng. & Mfg. Co., Baltimore.
J. W. Paxson Co., Philadelphia, Pa.
E. J. Woodison Co., Toronto.
Stevens, F. B., Detroit, Mich.
Whitehead Bros. Co., Buffalo, N.Y.

Furnace Lining.
Can. Hanson & Van Winkle Co., Toronto.
Columbian Facing Mills Co., Buffalo, N.Y.
Dominion Fdry. Sup. Co., Toronto.
Elk Fire Brick Co., Hamilton, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hawley Down Draft Furnace Co., Easton, Pa.
J. S. McCormick Co., Pittsburg, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, F. B., Detroit, Mich.
E. J. Woodison Co., Toronto.

Furnaces.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hare Engineering Co., Toronto.
Hawley Down Draft Furnace Co., Easton, Pa.
J. S. McCormick Co., Pittsburg, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.
W. S. Rockwell Co., New York.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Furnaces, Brass.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Hare Engineering Co., Toronto.
Hawley Down Draft Furnace Co., Easton, Pa.
J. S. McCormick Co., Pittsburg, Pa.
Monarch Eng. & Mfg. Co., Baltimore.
J. W. Paxson Co., Philadelphia, Pa.
W. S. Rockwell Co., New York.
Stevens, F. B., Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Graphite Products.
Federal Fdry. Sup. Co., Cleveland.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Jonathan Bartley Crucible Co., Trenton, N.J.
J. S. McCormick Co., Pittsburg, Pa.
McCulloch-Dalzell Crucible Company, Pittsburg, Pa.

Grinders, Disc, Bench, Swing.
Ford Smith Machine Co., Hamilton, Ont.
Perfect Machinery Co., Galt, Ont.

Hoisting and Conveying Machinery.
A. R. Williams Machy. Co., Toronto.
W. D. Beath & Son, Toronto.
Northern Engineering Works, Detroit.
Whiting Foundry Equipment Co., Harvey, Ill.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Hoists, Electric, Pneumatic.
A. R. Williams Machy. Co., Toronto.
W. D. Beath & Son, Toronto.
Canadian Ingersoll-Rand Co., Ltd., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Curtis Pneumatic Machinery Co., St. St. Louis, Mo.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Northern Crane Works, Walkerville.
E. J. Woodison Co., Toronto.
Whiting Foundry Equipment Co., Harvey, Ill.

Hoists, Hand, Trolley.
Dominion Fdry. Sup. Co., Toronto.
Northern Crane Works, Walkerville.
E. J. Woodison Co., Toronto.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Whiting Foundry Equipment Co., Harvey, Ill.

Hose and Couplings.
Can. Niagara Device Co., Bridgeburg, Ont.

Ingot Metals.
Frankel Bros., Toronto.

Iron Cements.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Federal Fdry. Sup. Co., Cleveland.
J. W. Paxson Co., Philadelphia, Pa.
Smooth-On Mfg. Co., Jersey City.
Stevens, F. B., Detroit, Mich.

Iron Filler.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Federal Fdry. Sup. Co., Cleveland.
J. S. McCormick Co., Pittsburg, Pa.
J. W. Paxson Co., Philadelphia, Pa.
Smooth-On Mfg. Co., Jersey City.
Stevens, F. B., Detroit, Mich.
E. J. Woodison Co., Toronto.

Jersey Sand.
Columbian Facing Mills Co., Buffalo, N.Y.

Ladles, Foundry.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Federal Fdry. Sup. Co., Cleveland.
J. S. McCormick Co., Pittsburg, Pa.
Hamilton Facing Mills Co., Ltd., Hamilton, Ont.
Northern Crane Works, Walkerville, Ont.
Monarch Eng. & Mfg. Co., Baltimore.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Ladle Heaters.
Hawley Down Draft Furnace Co., Easton, Pa.
J. S. McCormick Co., Pittsburg, Pa.

Ladle Stoppers, Ladle Nozzles, and Sleeves (Graphite).
J. W. Paxson Co., Philadelphia, Pa.
Seidel, R. B., Philadelphia.
McCulloch-Dalzell Crucible Company, Pittsburg, Pa.

Melting Pots.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Hamilton Facing Mills Co., Ltd., Hamilton, Ont.
Monarch Eng. & Mfg. Co., Baltimore.
Stevens, F. B., Detroit, Mich.
E. J. Woodison Co., Toronto.

Millville Gravel.
Columbian Facing Mills Co., Buffalo, N.Y.

Metallurgists.
Canadian Laboratories, Toronto.
Charles C. Kawin Co., Toronto.
Frankel Bros., Toronto.
Toronto Testing Laboratories, Toronto.
M. & L. Samuel Benjamin Co., Toronto.

Mixers.
J. S. McCormick Co., Pittsburg, Pa.
Standard Sand & Machine Co., Cleveland, O.
Sand Mixing Machine Co. of Can., Brantford.
J. W. Paxson Co., Philadelphia, Pa.

Molders' Tools.
Can. Hanson & Van Winkle Co., Toronto.
Wr. Dobson, Canastota, N.Y.
Dominion Fdry. Sup. Co., Toronto.
Stevens, Frederic B., Detroit.
Hamilton Facing Mills Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
E. J. Woodison Co., Toronto.

Molding Machines.
Berkshire Mfg. Co., Cleveland, O.
Can. Hanson & Van Winkle Co., Toronto.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Dominion Fdry. Sup. Co., Toronto.
Federal Fdry. Sup. Co., Cleveland.
Hamilton Facing Mills Co., Ltd., Hamilton, Ont.
Stevens, Frederic B., Detroit.
Midland Machine Co., Detroit.
J. S. McCormick Co., Pittsburg, Pa.
Tabor Mfg. Co., Philadelphia.
Stuart Machinery Co., Winnipeg.
E. J. Woodison Co., Toronto.

Molding Sand.
Can. Hanson & Van Winkle Co., Toronto.
T. E. Coupe, Toronto.
Dominion Fdry. Sup. Co., Toronto.
Hamilton Facing Mills Co., Ltd., Hamilton, Ont.
Interstate Sand Co., Zanesville, O.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit.
E. J. Woodison Co., Toronto.
Whitehead Bros. Co., Buffalo, N.Y.

Molding Sifters.
Whitehead Bros. Co., Buffalo, N.Y.

Ovens for Core-baking and Drying.
Hare Engineering Co., Toronto.
J. S. McCormick Co., Pittsburg, Pa.
Oven Equipment & Mfg. Co., New Haven, Conn.

Oxy-Acetylene Welding.
W. D. Beath & Son, Toronto.

Oil and Gas Furnaces.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Hamilton Facing Mill Co., Ltd., Hamilton.
Monarch Eng. & Mfg. Co., Baltimore.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit.
E. J. Woodison Co., Toronto.

Patterns, Metal and Wood.
Wells Pattern & Machine Works, Limited, Toronto.
Guelph Pattern Works, Guelph, Ont.
F. W. Quinn, Hamilton, Ont.

Pattern Shop Equipment.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Hamilton Facing Mill Co., Ltd., Hamilton.
J. S. McCormick Co., Pittsburg, Pa.
J. W. Paxson Co., Philadelphia, Pa.
F. W. Quinn, Hamilton, Ont.
Stevens, F. B., Detroit, Mich.
Hamilton Pattern Works, Hamilton.
Stuart Machinery Co., Winnipeg.
E. J. Woodison Co., Toronto.

Pig Iron.
Frankel Bros., Toronto.
M. & L. Samuel Benjamin Co., Toronto.

Phosphorizers.
J. S. McCormick Co., Pittsburg, Pa.
McCulloch-Dalzell Crucible Company, Pittsburg, Pa.
Whitehead Bros. Co., Buffalo, N.Y.

Plumbago.
Can. Hanson & Van Winkle Co., Toronto.
Columbian Facing Mills Co., Buffalo, N.Y.
Dominion Fdry. Sup. Co., Toronto.
J. S. McCormick Co., Pittsburg, Pa.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.
E. J. Woodison Co., Toronto.

Plating and Polishing Supplies.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Chas. J. Menzemer, Niagara Falls, Ont.
W. W. Wells, Toronto.
E. J. Woodison Co., Toronto.

Pneumatic Paint Spray.
Can. Niagara Device Co., Bridgeburg, Ont.

Polishing Wheels.
Chas. J. Menzemer, Niagara Falls, Ont.
Perfect Machinery Co., Galt, Ont.
W. W. Wells, Toronto.

Ramming Plates and Machines.
Can. Hanson & Van Winkle Co., Toronto.
Canadian Ingersoll-Rand Co., Ltd., Montreal.
Dominion Fdry. Sup. Co., Toronto.
Stevens, F. B., Detroit, Mich.
E. J. Woodison Co., Toronto.

Retorts.
Jonathan Bartley Crucible Co., Trenton, N.J.

Riddles.
Can. Hanson & Van Winkle Co., Toronto.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.
E. J. Woodison Co., Toronto.
Federal Fdry. Sup. Co., Cleveland.
Dominion Fdry. Sup. Co., Toronto.
E. Greening Wire Co., Hamilton.

Rosin.
Columbian Facing Mills Co., Buffalo, N.Y.
J. S. McCormick Co., Pittsburg, Pa.

Rouge.
Chas. J. Menzemer, Niagara Falls, Ont.
W. W. Wells, Toronto.

Sand Blast Machinery.
Can. Hanson & Van Winkle Co., Toronto.
Canadian Ingersoll-Rand Co., Ltd., Montreal.
Can. Niagara Device Co., Bridgeburg, Ont.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Dominion Fdry. Sup. Co., Toronto.
Federal Fdry. Sup. Co., Cleveland.
Hamilton Facing Mill Co., Ltd., Hamilton.
J. S. McCormick Co., Pittsburg, Pa.
Pangborn Corp., Hagerstown, Ind.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.
W. W. Sly, Cleveland, Ohio.
E. J. Woodison Co., Toronto.

Sand Blast Rolling Barrels.
New Haven Sand Blast Co., New Haven, Conn.
Whitehead Bros. Co., Buffalo, N.Y.

Sand Blast Devices.
Can. Niagara Device Co., Bridgeburg, Ont.
J. S. McCormick Co., Pittsburg, Pa.

Sand Molding.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.
E. J. Woodison Co., Toronto.

Sand Sifters.
Battle Creek Sand Sifter Co., Battle Creek, Mich.
Can. Hanson & Van Winkle Co., Toronto.
Canadian Ingersoll-Rand Co., Ltd., Montreal.
Federal Fdry. Sup. Co., Cleveland.
Dominion Fdry. Sup. Co., Toronto.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
J. W. Paxson Co., Philadelphia, Pa.
Standard Sand & Machine Co., Cleveland.
Stevens, F. B., Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Saws, Hack.
Ford-Smith Machine Co., Hamilton, Ont.

Sea Coal.
Columbian Facing Mills Co., Buffalo, N.Y.
J. S. McCormick Co., Pittsburg, Pa.

Shovels.
Can. Shovel & Tool Co., Hamilton, Ont.

Sieves.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Toronto.
B. Greening Wire Co., Hamilton.
J. S. McCormick Co., Pittsburg, Pa.
Stevens, F. B., Detroit, Mich.

Silica Wash.
Columbian Facing Mills Co., Buffalo, N.Y.
J. S. McCormick Co., Pittsburg, Pa.

Soapstone.
Federal Fdry. Sup. Co., Cleveland.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.

Special Machinery.
Perfect Machinery Co., Galt, Ont.
Wells Pattern & Machine Works, Limited, Toronto.

Sprue Cutters.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Sup. Co., Montreal.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Federal Fdry. Sup. Co., Cleveland.
J. S. McCormick Co., Pittsburg, Pa.
J. W. Paxson Co., Philadelphia, Pa.
F. B. Shuster Co., New Haven, Conn.
Stevens, F. B., Detroit, Mich.
E. J. Woodison Co., Toronto.

Squeezers, Power.
Dominion Fdry. Sup. Co., Montreal.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
E. J. Woodison Co., Toronto.

Talc.
Can. Hanson & Van Winkle Co., Toronto.
Federal Fdry. Supply Co., Cleveland.
Dominion Fdry. Supply Co., Toronto.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
E. J. Woodison Co., Toronto.
J. W. Paxson Co., Philadelphia, Pa.

Teeming Crucibles and Funnels.
McCulloch-Dalzell Crucible Company, Pittsburg, Pa.

Track, Overhead.
W. D. Beath & Son, Toronto.
Dominion Bridge Co., Montreal.
Dominion Fdry. Supply Co., Montreal.
Northern Crane Works, Ltd., Walkerville, Ont.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
J. W. Paxson Co., Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.
Wright Mfg. Co., Lisbon, O.

Tripoli.
Chas. J. Menzemer, Niagara Falls, Ont.
W. W. Wells, Toronto.

Trolleys and Trolley Systems.
W. D. Beath & Son, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Canadian Ingersall-Rand Co., Ltd., Montreal.
Federal Fdry. Supply Co., Cleveland.
Dominion Fdry. Supply Co., Montreal.
Northern Crane Works, Ltd., Walkerville, Ont.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
J. W. Paxson Co., Philadelphia, Pa.
Standard Sand & Machine Co., Cleveland.
Stevens, F. B., Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Trucks, Dryer and Factory.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Supply Co., Toronto.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Tumblers.
Dominion Fdry. Supply Co., Montreal.
Dominion Fdry. Supply Co., Toronto.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
J. S. McCormick Co., Pittsburg, Pa.
Northern Crane Works, Ltd., Walkerville, Ont.
J. W. Paxson Co., Philadelphia, Pa.
E. J. Woodison Co., Toronto.
Whiting Foundry Equipment Co., Harvey, Ill.

Turntables.
W. D. Beath & Son, Toronto.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Supply Co., Montreal.
Federal Fdry. Supply Co., Cleveland.
J. S. McCormick Co., Pittsburg, Pa.
Northern Crane Works, Walkerville.
J. W. Paxson Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Toronto.

Vent Wax.
Columbian Facing Mills Co., Buffalo, N. Y.
J. S. McCormick Co., Pittsburg, Pa.
United Compound Co., Buffalo N. Y.

Vibrators.
Berkshire Mfg. Co., Cleveland, O.

Welding and Cutting.
Metals Welding Co., Cleveland, O.

Wheels, Polishing, Abrasive.
Bennett-O'Connell Co., Chicago.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Supply Co., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
Chas. J. Menzemer, Niagara Falls, Ont.
Stevens, F. B., Detroit, Mich.
United Compound Co., Buffalo, N.Y.
E. J. Woodison Co., Toronto.

Wire Wheels.
Can. Hanson & Van Winkle Co., Toronto.
Dominion Fdry. Supply Co., Toronto.
Federal Fdry. Supply Co., Cleveland.
Frederic B. Stevens, Detroit.
Hamilton Facing Mill Co., Ltd., Hamilton, Ont.
W. W. Wells, Toronto.
J. S. McCormick Co., Pittsburg, Pa.
E. J. Woodison Co., Toronto.

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